

THE LOS ALAMOS NATIONAL LABORATORY SITE-WIDE ENVIRONMENTAL IMPACT STATEMENT PROCESS

The United States Department of Energy (DOE) has a policy (10 Code of Federal Regulations [CFR] 1021.330) of preparing a Site-Wide Environmental Impact Statement (SWEIS) for certain large, multiple-facility sites, such as the Los Alamos National Laboratory (LANL). The purpose of a SWEIS is to provide DOE and its stakeholders with an analysis of the environmental impacts resulting from ongoing and reasonably foreseeable new operations and facilities and reasonable alternatives at the DOE site. The SWEIS analyzes four alternatives for the continued operation of LANL to identify the potential effects that each alternative could have on the human environment.

The SWEIS Advance Notice of Intent, published in the *Federal Register* (FR) on August 10, 1994 (59 FR 40889), identified possible issues and alternatives to be analyzed. Based on public input received during prescoping, DOE published the Notice of Intent to prepare the SWEIS in the *Federal Register* on May 12, 1995 (60 FR 25697). DOE held a series of public meetings during prescoping and scoping to provide opportunities for stakeholders to identify the issues, environmental concerns, and alternatives that should be analyzed in the SWEIS. An Implementation Plan¹ was published in November 1995 to summarize the results of scoping, describe the scope of the SWEIS based on the scoping process, and present an outline for the draft SWEIS. The Implementation Plan also included a discussion of the issues reflected in public comments during scoping.

In addition to the required meetings and documents described above, the SWEIS process has included a number of other activities intended to enhance public participation in this effort. These activities have included:

- Workshops to develop the Greener Alternative described and analyzed in the SWEIS.
- Meetings with and briefings to representatives of federal, state, tribal, and local governments during prescoping, scoping, and preparation of the draft SWEIS.
- Preparation and submission to the Los Alamos Community Outreach Center of information requested by members of the public related to LANL operations and proposed projects.
- Numerous Open Forum public meetings in the communities around LANL to discuss LANL activities, the status of the SWEIS, and other issues raised by the public.

The draft SWEIS was distributed to interested stakeholders for comment. The comment period extended from May 15, 1998, to July 15, 1998. Public hearings on the draft SWEIS were announced in the *Federal Register*, as well as community newspapers and radio broadcasts. Public hearings were held in Los Alamos, Santa Fe, and Española, New Mexico, on June 9, 1998, June 10, 1998, and June 24, 1998, respectively.

Oral and written comments were accepted during the 60-day comment period for the draft SWEIS. All comments received, whether orally or in writing, were considered in preparation of the final SWEIS. The final SWEIS includes a new volume IV with responses to individual comments and a discussion of general major issues. DOE will prepare a Record of Decision no sooner than 30 days after the final SWEIS Notice of Availability is published in the *Federal Register*. The Record of Decision will describe the rationale used for DOE's selection of an alternative or portions of the alternatives. Following the issuance of the Record of Decision, a Mitigation Action Plan may also be issued to describe any mitigation measures that DOE commits to in concert with its decision.

¹. DOE *National Environmental Policy Act* regulations (10 CFR 1021) previously required that an implementation plan be prepared; a regulation change (61 FR 64604) deleted this requirement. An implementation plan was prepared for this SWEIS.

COVER SHEET

Responsible Agency: U.S. Department of Energy (DOE)

Cooperating Agency: Incorporated County of Los Alamos

Title: Site-Wide Environmental Impact Statement for the Continued Operation of the Los Alamos National Laboratory, Los Alamos, New Mexico (DOE/EIS-0238)

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Abstract: DOE proposes to continue operating the Los Alamos National Laboratory (LANL) located in Los Alamos County, in north-central New Mexico. DOE has identified and assessed four alternatives for the operation of LANL: (1) No Action, (2) Expanded Operations, (3) Reduced Operations, and (4) Greener. Expanded Operations is DOE's Preferred Alternative, with the exception that DOE would only implement pit manufacturing at a level of 20 pits per year. In the No Action Alternative, DOE would continue the historical mission support activities LANL has conducted at planned operational levels. In the Expanded Operations Alternative, DOE would operate LANL at the highest levels of activity currently foreseeable, including full implementation of the mission assignments from recent programmatic documents. Under the Reduced Operations Alternative, DOE would operate LANL at the minimum levels of activity necessary to maintain the capabilities to support the DOE mission in the near term. Under the Greener Alternative, DOE would operate LANL to maximize operations in support of nonproliferation, basic science, materials science, and other nonweapons areas, while minimizing weapons activities. Under all of the alternatives, the affected environment is primarily within 50 miles (80 kilometers) of LANL. Analyses indicate little difference in the environmental impacts among alternatives. The primary discriminators are: collective worker risk due to radiation exposure, socioeconomic effects due to LANL employment changes, and electrical power demand.

Public Comment and DOE Decision: The draft SWEIS was released to the public for review and comment on May 15, 1998. The comment period extended until July 15, 1998, although late comments were accepted to the extent practicable. All comments received were considered in preparation of the final SWEIS¹. DOE will utilize the analysis in this final SWEIS and prepare a Record of Decision on the level of continued operation of LANL. This decision will be no sooner than 30 days after the Notice of Availability of the final SWEIS is published in the *Federal Register*.

¹. Changes made to this SWEIS since publication of the draft SWEIS are marked with a vertical bar to the right or left of the text.

TABLE OF CONTENTS

Table of Contents	i
List of Figures	xxi
List of Tables	xxvii
Abbreviations and Acronyms	xli
Measurements and Conversions	liii

CHAPTER 1.0

INTRODUCTION AND PURPOSE AND NEED FOR AGENCY ACTION..... 1-1

1.1 LANL SUPPORT FOR DOE MISSIONS	1-1
1.1.1 National Security Assignments to LANL	1-4
1.1.1.1 Stockpile Stewardship Assignments	1-4
1.1.1.2 Stockpile Management Assignments.....	1-4
1.1.1.3 Accelerator Production of Tritium Assignment.....	1-6
1.1.1.4 Stabilization of Commercial Nuclear Materials Assignment	1-7
1.1.1.5 Nonproliferation and Counter-Proliferation Assignments.....	1-7
1.1.1.6 Other National Security Assignments	1-8
1.1.2 Energy Resources Assignments.....	1-8
1.1.3 Environmental Quality Assignments.....	1-8
1.1.4 Science Assignments	1-9
1.1.4.1 Nuclear Criticality Studies.....	1-9
1.1.4.2 Reimbursable Work.....	1-9
1.1.4.3 University Research and Development	1-10
1.1.5 DOE National Laboratory System.....	1-10
1.2 PURPOSE AND NEED FOR AGENCY ACTION.....	1-10
1.3 OVERVIEW OF THE ALTERNATIVES CONSIDERED	1-12
1.4 DECISIONS TO BE SUPPORTED BY THE SWEIS	1-13
1.4.1 Public Comment Process on the Draft SWEIS	1-13
1.5 RELATIONSHIP TO OTHER DOE NEPA DOCUMENTS	1-13
1.5.1 Waste Management Programmatic Environmental Impact Statement (DOE/EIS-0200)	1-14
1.5.2 Stockpile Stewardship and Management Programmatic Environmental Impact Statement (DOE/EIS-0236)	1-15
1.5.3 Waste Isolation Pilot Plant Disposal Phase Supplemental Environmental Impact Statement (DOE/EIS-0026-S2)	1-17

1.5.4	Medical Isotopes Production Project: Molybdenum-99 and Related Isotopes Environmental Impact Statement (DOE/EIS-0249)	1-18
1.5.5	Storage and Disposition of Weapons-Usable Fissile Materials Programmatic Environmental Impact Statement (DOE/EIS-0229)	1-18
1.5.6	EIS on Management of Certain Plutonium Residues and Scrub Alloy Stored at the Rocky Flats Environmental Technology Site (DOE/EIS-0277)	1-19
1.5.7	Pit Disassembly and Conversion Demonstration Environmental Assessment (DOE/EA-1207)	1-19
1.5.8	Surplus Plutonium Disposition Environmental Impact Statement (DOE/EIS-0283)	1-20
1.5.9	EIS for Siting, Construction, and Operation of the Spallation Neutron Source (DOE/EIS-0247)	1-20
1.5.10	EIS for the Proposed Conveyance and Transfer of Certain Land Tracts Located Within Los Alamos and Santa Fe Counties and Los Alamos National Laboratory	1-21
1.5.11	Environmental Assessment for the Proposed Strategic Computing Complex (DOE/EA-1250)	1-21
1.6	OVERVIEW OF THE LANL SWEIS	1-22
1.6.1	Objectives of the SWEIS	1-22
1.6.2	SWEIS Approaches	1-22
1.6.3	Consideration of Future Projects	1-23
1.6.3.1	Emerging Actions at LANL	1-24
1.6.4	Cooperating Agency	1-25
1.6.5	Organization of the SWEIS	1-25
1.7	CHANGES TO THE DRAFT SWEIS	1-27
1.7.1	Summary of Significant Changes	1-27
1.7.1.1	Revised Preferred Alternative	1-27
1.7.1.2	Enhanced Pit Manufacturing	1-27
1.7.1.3	Wildfire	1-28
1.7.1.4	Comparison Between the Rocky Flats Plant and LANL	1-28
1.7.1.5	CMR Building Seismic Upgrades	1-28
1.7.1.6	Strategic Computing Complex	1-28
1.7.1.7	Conveyance and Transfer of DOE Land	1-29
1.7.2	Next Steps	1-29
	REFERENCES	1-31

CHAPTER 2.0**BACKGROUND ON LOS ALAMOS NATIONAL LABORATORY****FACILITIES AND ACTIVITIES..... 2-1**

2.1	OVERVIEW OF LANL ACTIVITIES	2-1
2.1.1	Categories of Direct-Funded Activities	2-2
2.1.1.1	Theory, Modeling, and High Performance Computing	2-2
2.1.1.2	Experimental Science and Engineering	2-2
2.1.1.3	Advanced and Nuclear Materials Research, Development, and Applications	2-3
2.1.2	Supporting Activities	2-4
2.1.2.1	Waste Management	2-4
2.1.2.2	Infrastructure and Central Services	2-6
2.1.2.3	Maintenance and Refurbishment	2-6
2.1.2.4	Environmental, Ecological, and Natural Resources Management Activities	2-8
2.1.2.5	Environmental Restoration	2-9
2.1.3	Responsibilities for Safe Operations at LANL	2-14
2.1.3.1	Defense Nuclear Facilities Safety Board	2-15
2.2	DESCRIPTION OF LANL FACILITIES	2-16
2.2.1	Technical Areas	2-17
2.2.2	SWEIS Key Facilities	2-17
2.2.2.1	Plutonium Facility Complex (TA-55)	2-24
2.2.2.2	Tritium Facilities (TA-16, TA-21)	2-33
2.2.2.3	Chemistry and Metallurgy Research Building (TA-3-29)	2-38
2.2.2.4	Pajarito Site: Los Alamos Critical Experiments Facility (TA-18)	2-46
2.2.2.5	Sigma Complex (TA-3-66, TA-3-35, TA-3-141, and TA-3-159)	2-50
2.2.2.6	Materials Science Laboratory (TA-3-1698)	2-53
2.2.2.7	Target Fabrication Facility (TA-35)	2-56
2.2.2.8	Machine Shops (TA-3)	2-58
2.2.2.9	High Explosives Processing	2-60
2.2.2.10	High Explosives Testing: TA-14 (Q-Site), TA-15 (R-Site), TA-36 (Kappa-Site), TA-39 (Ancho Canyon Site), and TA-40 (DF-Site)	2-73
2.2.2.11	Los Alamos Neutron Science Center (TA-53)	2-84
2.2.2.12	Health Research Laboratory (TA-43)	2-92
2.2.2.13	Radiochemistry Facility (TA-48)	2-95
2.2.2.14	Radioactive Liquid Waste Treatment Facility (TA-50)	2-99

2.2.2.15	Solid Radioactive and Chemical Waste Facilities (TA-54 and TA-50)	2-103
2.2.3	Nuclear and Moderate Hazard Facilities Not Analyzed as Key Facilities.....	2-116
2.2.3.1	Hazard Category 2 Nuclear Facilities	2-116
2.2.3.2	Hazard Category 3 Nuclear Facilities	2-116
2.2.3.3	Nonnuclear Moderate Hazard Facilities	2-117
2.3	THE ROLE OF THE UNIVERSITY OF CALIFORNIA IN LANL ACTIVITIES.....	2-118
2.4	RECENT LANL FUNDING LEVELS	2-118
	REFERENCES	2-121

CHAPTER 3.0

ALTERNATIVES FOR THE CONTINUED OPERATION OF THE LOS ALAMOS NATIONAL LABORATORY

3-1

3.1	NO ACTION ALTERNATIVE.....	3-4
3.1.1	Plutonium Facility Complex	3-4
3.1.2	Tritium Facilities	3-6
3.1.3	Chemistry and Metallurgy Research Building.....	3-7
3.1.4	Pajarito Site (Los Alamos Critical Experiments Facility).....	3-8
3.1.5	Sigma Complex	3-8
3.1.6	Materials Science Laboratory	3-9
3.1.7	Target Fabrication Facility.....	3-9
3.1.8	Machine Shops.....	3-9
3.1.9	High Explosives Processing Facilities.....	3-10
3.1.10	High Explosives Testing	3-10
3.1.11	Los Alamos Neutron Science Center.....	3-11
3.1.12	Health Research Laboratory	3-13
3.1.13	Radiochemistry Facility.....	3-13
3.1.14	Radioactive Liquid Waste Treatment Facility.....	3-14
3.1.15	Solid Radioactive and Chemical Waste Facilities.....	3-14
3.2	EXPANDED OPERATIONS ALTERNATIVE.....	3-16
3.2.1	Plutonium Facility Complex	3-17
3.2.2	Tritium Facilities	3-18
3.2.3	Chemistry and Metallurgy Research Building.....	3-19
3.2.4	Pajarito Site (Los Alamos Critical Experiments Facility).....	3-21
3.2.5	Sigma Complex	3-21

3.2.6	Materials Science Laboratory	3-22
3.2.7	Target Fabrication Facility.	3-22
3.2.8	Machine Shops.	3-23
3.2.9	High Explosives Processing Facilities.	3-23
3.2.10	High Explosives Testing	3-24
3.2.11	Los Alamos Neutron Science Center.	3-24
3.2.12	Health Research Laboratory	3-27
3.2.13	Radiochemistry Facility.	3-28
3.2.14	Radioactive Liquid Waste Treatment Facility.	3-28
3.2.15	Solid Radioactive and Chemical Waste Facilities.	3-29
3.3	REDUCED OPERATIONS ALTERNATIVE.	3-30
3.3.1	Plutonium Facility Complex	3-31
3.3.2	Tritium Facilities	3-32
3.3.3	Chemistry and Metallurgy Research Building.	3-32
3.3.4	Pajarito Site (Los Alamos Critical Experiments Facility).	3-33
3.3.5	Sigma Complex	3-34
3.3.6	Materials Science Laboratory	3-34
3.3.7	Target Fabrication Facility.	3-34
3.3.8	Machine Shops.	3-34
3.3.9	High Explosives Processing Facilities.	3-35
3.3.10	High Explosives Testing	3-35
3.3.11	Los Alamos Neutron Science Center.	3-35
3.3.12	Health Research Laboratory	3-36
3.3.13	Radiochemistry Facility.	3-37
3.3.14	Radioactive Liquid Waste Treatment Facility.	3-37
3.3.15	Solid Radioactive and Chemical Waste Facilities.	3-38
3.4	GREENER ALTERNATIVE	3-39
3.4.1	Plutonium Facility Complex	3-40
3.4.2	Tritium Facilities	3-41
3.4.3	Chemistry and Metallurgy Research Building.	3-42
3.4.4	Pajarito Site (Los Alamos Critical Experiments Facility).	3-42
3.4.5	Sigma Complex	3-43
3.4.6	Materials Science Laboratory	3-43
3.4.7	Target Fabrication Facility.	3-44
3.4.8	Machine Shops.	3-44
3.4.9	High Explosives Processing Facilities.	3-45

3.4.10	High Explosives Testing	3-45
3.4.11	Los Alamos Neutron Science Center	3-45
3.4.12	Health Research Laboratory	3-47
3.4.13	Radiochemistry Facility	3-47
3.4.14	Radioactive Liquid Waste Treatment Facility	3-48
3.4.15	Solid Radioactive and Chemical Waste Facilities	3-48
3.5	ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL IN THE SWEIS	3-49
3.5.1	Decontamination and Decommissioning LANL	3-50
3.5.2	Elimination of All Weapons-Related Work (Including Stockpile Stewardship and Management) from Continued Operation of LANL	3-50
3.5.3	Operating LANL Exclusively as a National Environmental Research Park	3-51
3.5.4	Privatizing the Operations of LANL	3-52
3.6	COMPARISON OF POTENTIAL CONSEQUENCES AMONG ALTERNATIVES FOR CONTINUED OPERATION OF LANL	3-53
3.6.1	Summary of Differences in Activities Among the SWEIS Alternatives	3-53
3.6.2	Consequences of SWEIS Alternatives	3-53
3.6.2.1	Land Resources	3-54
3.6.2.2	Geology, Geological Conditions, and Soils	3-55
3.6.2.3	Water Resources	3-55
3.6.2.4	Air Quality	3-55
3.6.2.5	Ecological and Biological Resources	3-56
3.6.2.6	Human Health	3-56
3.6.2.7	Environmental Justice	3-56
3.6.2.8	Cultural Resources	3-57
3.6.2.9	Socioeconomics, Infrastructure, and Waste Management	3-57
3.6.2.10	Transportation	3-58
3.6.2.11	Accidents (Other Than Transportation Accidents and Worker Physical Safety Incidents/Accidents)	3-59
3.6.3	Project-Specific Consequences	3-62
3.6.3.1	Expansion of TA-54/Area G Low-Level Radioactive Waste Disposal Area	3-62
3.6.3.2	Enhancement of Plutonium Pit Manufacturing	3-65
3.6.4	Consequences of Environmental Restoration Activities	3-70
	REFERENCES	3-145

CHAPTER 4.0	
AFFECTED ENVIRONMENT	4-1
4.1 LAND RESOURCES	4-3
4.1.1 Land Use	4-3
4.1.1.1 Stewardship and Land Use Authority	4-4
4.1.1.2 LANL Land Use	4-6
4.1.1.3 Los Alamos County Land Use	4-7
4.1.1.4 Potential Land Transfers and Related Land Use Issues	4-9
4.1.1.5 Santa Fe National Forest Land Use	4-10
4.1.1.6 Bandelier National Monument Land Use	4-10
4.1.1.7 American Indian Pueblo Land Use	4-13
4.1.2 Visual Environment	4-14
4.1.2.1 Physical Characteristics Within the Visual Environment	4-14
4.1.2.2 Air Quality and Light Pollution Within the Visual Environment	4-16
4.1.3 Noise, Air Blasts, and Vibration Environment	4-16
4.1.3.1 Noise Level Regulatory Limits and LANL Administrative Requirements	4-18
4.1.3.2 Existing LANL Noise Air Blast and Vibration Environment	4-19
4.2 GEOLOGY AND SOILS	4-22
4.2.1 Geology	4-22
4.2.2 Geologic Conditions	4-26
4.2.2.1 Volcanism	4-26
4.2.2.2 Seismic Activity	4-27
4.2.2.3 Slope Stability, Subsidence, and Soil Liquefaction	4-34
4.2.3 Soils	4-34
4.2.3.1 Soil Monitoring	4-34
4.2.3.2 Soil Erosion	4-39
4.2.4 Mineral Resources	4-40
4.2.5 Paleontological Resources	4-40
4.3 WATER RESOURCES	4-42
4.3.1 Surface Water	4-44
4.3.1.1 Surface Water Monitoring	4-47
4.3.1.2 Surface Water Quality Standards	4-52
4.3.1.3 National Pollutant Discharge Elimination System Permitted Outfalls	4-52
4.3.1.4 Sediments	4-63

4.3.1.5	Surface Water Quality	4-68
4.3.1.6	Floodplains.	4-69
4.3.2	Groundwater Resources.	4-70
4.3.2.1	Groundwater Monitoring	4-72
4.3.2.2	Groundwater Quality	4-75
4.3.2.3	Transport of Radionuclides and Chemicals	4-78
4.3.2.4	Public Water Supply	4-79
4.3.2.5	Regional Groundwater.	4-82
4.4	AIR QUALITY AND CLIMATE	4-83
4.4.1	Climatology and Meteorology	4-83
4.4.1.1	Wind Conditions	4-86
4.4.1.2	Severe Weather	4-88
4.4.2	Nonradiological Air Quality	4-88
4.4.2.1	Applicable Requirements and Guidelines	4-88
4.4.2.2	Sources of Nonradiological Emissions	4-89
4.4.2.3	Existing Ambient Air Conditions	4-90
4.4.3	Radiological Air Quality	4-90
4.4.3.1	Radiological Emissions and Monitoring	4-91
4.4.3.2	Radiological Emission Standards	4-92
4.4.3.3	Radiation Doses from LANL Airborne Emissions	4-92
4.4.4	Visibility	4-93
4.5	ECOLOGICAL RESOURCES AND BIODIVERSITY.	4-95
4.5.1	Ecological Resources.	4-95
4.5.1.1	A Regional Approach	4-95
4.5.1.2	Wetlands	4-98
4.5.1.3	Canyons	4-107
4.5.1.4	Rio Grande.	4-111
4.5.1.5	Protected and Sensitive Species.	4-112
4.5.1.6	Management Plans.	4-119
4.5.1.7	Environmental Surveillance.	4-119
4.5.2	Biodiversity Considerations.	4-120
4.5.2.1	Physical Alteration of the Landscape	4-120
4.5.2.2	Disruption of Natural Processes	4-121
4.5.2.3	Overharvesting.	4-122
4.5.2.4	Introduction of Nonnative (Exotic) Species	4-122
4.5.2.5	Pollution.	4-123
4.5.3	Ecological Risk Considerations.	4-123
4.5.3.1	Background on Contamination at LANL.	4-123

4.5.3.2	Ecological Risk Assessments Performed for Threatened and Endangered Species	4-126
4.5.3.3	Ecological Risk	4-127
4.6	HUMAN HEALTH: WORKER AND PUBLIC HEALTH IN THE REGION AFFECTED BY LANL OPERATIONS	4-129
4.6.1	Public Health in the LANL Vicinity	4-129
4.6.1.1	Radiation in the Environment Around LANL	4-129
4.6.1.2	Chemicals in the Environment Around LANL	4-132
4.6.1.3	Cancer Incidence and Mortality in the Los Alamos Region	4-133
4.6.1.4	LANL Environmental Surveillance and Compliance Program	4-137
4.6.2	LANL Worker Health	4-137
4.6.2.1	Summary of Radiological and Chemical Exposure and Physical Hazard Incidents Affecting Worker Health During the 1990's	4-137
4.6.2.2	Ionizing Radiation Exposures of Workers	4-143
4.6.2.3	Nonionizing Radiation Exposure	4-143
4.6.2.4	Summary of Worker Health Studies at LANL	4-144
4.6.2.5	LANL Worker Health Programs	4-145
4.6.3	Emergency Response and Preparedness Program	4-147
4.6.3.1	Emergency Management and Response	4-148
4.6.3.2	Emergency Response for Explosions	4-148
4.6.3.3	Fire Protection	4-148
4.7	ENVIRONMENTAL JUSTICE	4-149
4.7.1	Region and Population Considered	4-149
4.7.2	Minority Population	4-150
4.7.3	Low-Income Population	4-150
4.8	CULTURAL RESOURCES	4-157
4.8.1	Prehistoric Period	4-159
4.8.2	Historic Period	4-160
4.8.3	Traditional Cultural Properties	4-160
4.8.4	Cultural Resource Management at LANL	4-163
4.9	SOCIOECONOMICS, INFRASTRUCTURE, AND WASTE MANAGEMENT	4-164
4.9.1	Socioeconomics	4-164
4.9.1.1	Demographics	4-164
4.9.1.2	Regional Incomes	4-164
4.9.1.3	Regional Labor Force and Educational Attainment	4-164

4.9.1.4	The Regional Economy	4-166
4.9.1.5	The LANL-Affiliated Workforce	4-167
4.9.1.6	University of California Procurement	4-170
4.9.1.7	Role of LANL in the Regional Economy	4-170
4.9.1.8	Community Resources and Social Services.	4-172
4.9.2	LANL Infrastructure and Central Services	4-178
4.9.2.1	Utilities.	4-178
4.9.2.2	Safeguards and Security.	4-184
4.9.2.3	Fire Protection	4-187
4.9.3	Waste Management	4-187
4.9.3.1	Wastewater Treatment and Effluent Reduction.	4-187
4.9.3.2	Solid Waste	4-188
4.9.3.3	Radioactive and Hazardous Waste	4-188
4.9.4	Contaminated Space Within LANL Facilities.	4-191
4.10	TRANSPORTATION	4-195
4.10.1	Regional and Site Transportation Routes	4-195
4.10.2	Transportation Accidents.	4-197
4.10.3	LANL Shipments.	4-197
4.10.3.1	On-Site Shipments.	4-197
4.10.3.2	Off-Site Shipments	4-200
REFERENCES	4-203

CHAPTER 5.0

ENVIRONMENTAL CONSEQUENCES 5-1

5.1	IMPACT ANALYSIS METHODOLOGIES.	5-3
5.1.1	Land Resources Methodology	5-3
5.1.1.1	Land Use	5-3
5.1.1.2	Visual Resources	5-3
5.1.1.3	Noise	5-3
5.1.2	Geology and Soils Methodology	5-3
5.1.3	Water Resources Methodology	5-4
5.1.4	Air Quality Methodology.	5-5
5.1.4.1	Nonradiological Air Quality	5-5
5.1.4.2	Radiological Air Quality	5-8
5.1.5	Ecological Resources, Biodiversity, and Ecological Risk Methodology	5-10
5.1.6	Human Health Methodology	5-11

5.1.7	Environmental Justice Methodology	5–14
5.1.8	Cultural Resources Methodology	5–15
5.1.9	Socioeconomics, Infrastructure, and Waste Management Methodology.....	5–16
5.1.9.1	Socioeconomics	5–16
5.1.9.2	Infrastructure	5–18
5.1.9.3	Waste Management	5–18
5.1.9.4	Contaminated Space	5–18
5.1.10	Transportation Methodology	5–19
5.1.10.1	Determination of Shipment Amounts, Materials, and Physical Forms.....	5–20
5.1.10.2	Shipment Routes and Distances.....	5–20
5.1.10.3	Vehicle-Related Risks	5–21
5.1.10.4	Cargo-Related Risks	5–22
5.1.11	Accident Analysis Methodology	5–24
5.1.11.1	Introduction	5–24
5.1.11.2	Meaning of Risk and Frequency as Used in This SWEIS.....	5–26
5.1.11.3	Characterization of the Risk from Accidents.....	5–26
5.1.11.4	Determining the Increment in Risk Among Alternatives	5–27
5.1.11.5	Methodology for Selection of Accidents for Analysis	5–27
5.1.11.6	Conservatism in the Analyses	5–28
5.1.11.7	Accident Scenario Screening and Selection	5–28
5.1.11.8	Detailed Accident Evaluations.....	5–33
5.1.11.9	Worker Accident Screening.....	5–34
5.1.11.10	Detailed Worker Accident Evaluations	5–35
5.1.11.11	Uncertainties and Sensitivities.....	5–35
5.1.11.12	Summary of Methodology for Supplement Analysis, SSM PEIS	5–36
5.2	IMPACTS OF THE NO ACTION ALTERNATIVE	5–38
5.2.1	Land Resources	5–38
5.2.1.1	Land Use	5–38
5.2.1.2	Visual Resources	5–38
5.2.1.3	Noise	5–39
5.2.2	Geology and Soils	5–40
5.2.2.1	Seismic Events or Volcanic Eruptions.....	5–40
5.2.2.2	Slope Stability/Soil Erosion.....	5–40
5.2.2.3	Soils	5–40
5.2.2.4	Mineral Resources	5–41
5.2.3	Water Resources	5–41
5.2.3.1	Surface Water	5–41

5.2.3.2	Groundwater	5–45
5.2.4	Air Quality	5–49
5.2.4.1	Nonradiological Air Quality Impacts	5–49
5.2.4.2	Radiological Air Quality Impacts	5–50
5.2.5	Ecological Resources, Biodiversity, and Ecological Risk	5–51
5.2.6	Human Health	5–57
5.2.6.1	Public Health	5–57
5.2.6.2	Worker Health	5–67
5.2.7	Environmental Justice	5–69
5.2.8	Cultural Resources	5–71
5.2.8.1	Prehistoric Resources	5–71
5.2.8.2	Historic Resources	5–73
5.2.8.3	Traditional Cultural Properties	5–74
5.2.9	Socioeconomics, Infrastructure, and Waste Management	5–74
5.2.9.1	Socioeconomic Impacts	5–75
5.2.9.2	Infrastructure Impacts	5–77
5.2.9.3	Waste Management	5–78
5.2.9.4	Contaminated Space	5–78
5.2.10	Transportation	5–80
5.2.10.1	Vehicle-Related Risks	5–80
5.2.10.2	Cargo-Related Risks	5–80
5.2.11	Accident Analysis	5–86
5.2.11.1	Multiple Source Release of Hazardous Material from Site-Wide Earthquake and Wildfire	5–86
5.2.11.2	Plutonium Releases from Manmade and Process Hazards at LANL	5–89
5.2.11.3	Highly Enriched Uranium Release from Process Hazard Accident at LANL	5–90
5.2.11.4	Tritium Release from a Manmade Hazard Accident	5–90
5.2.11.5	Chemical Releases from Manmade and Process Hazard Accidents at LANL	5–90
5.2.11.6	Worker Accidents at LANL	5–90
5.3	IMPACTS OF THE EXPANDED OPERATIONS ALTERNATIVE	5–100
5.3.1	Land Resources	5–100
5.3.1.1	Land Use Impacts	5–100
5.3.1.2	Visual Impacts	5–101
5.3.1.3	Noise	5–102
5.3.2	Geology and Soils	5–102
5.3.3	Water Resources	5–103

5.3.3.1	Surface Water	5–103
5.3.3.2	Alluvial Groundwater	5–104
5.3.3.3	Perched Groundwater	5–105
5.3.3.4	Main Aquifer	5–105
5.3.3.5	Area G	5–105
5.3.4	Air Quality	5–107
5.3.4.1	Nonradiological Air Quality Impacts	5–107
5.3.4.2	Radiological Air Quality Impacts	5–108
5.3.4.3	Project-Specific Siting and Construction Analyses.....	5–113
5.3.5	Ecological Resources, Biodiversity, and Ecological Risk.....	5–113
5.3.5.1	Project-Specific Siting and Construction Analyses.....	5–113
5.3.6	Human Health	5–114
5.3.6.1	Public Health	5–114
5.3.6.2	Worker Health	5–117
5.3.7	Environmental Justice	5–120
5.3.8	Cultural Resources.....	5–122
5.3.8.1	Prehistoric Resources.....	5–122
5.3.8.2	Historic Resources.....	5–124
5.3.8.3	Traditional Cultural Properties	5–124
5.3.9	Socioeconomics, Infrastructure, and Waste Management.....	5–124
5.3.9.1	Socioeconomic Impacts.....	5–124
5.3.9.2	Infrastructure Impacts	5–127
5.3.9.3	Waste Management	5–128
5.3.9.4	Contaminated Space	5–128
5.3.10	Transportation	5–131
5.3.10.1	Vehicle-Related Risks	5–131
5.3.10.2	Cargo-Related Risks	5–131
5.3.11	Accident Analysis	5–136
5.3.11.1	Multiple Source Release of Hazardous Material from Site-Wide Earthquake and Wildfire.....	5–136
5.3.11.2	Plutonium Releases from Manmade and Process Hazards at LANL.....	5–136
5.3.11.3	Highly Enriched Uranium Release from Process Hazard Accident	5–139
5.3.11.4	Tritium Release from a Manmade Hazard Accident at LANL.....	5–139
5.3.11.5	Chemical Releases from Manmade and Process Hazard Accidents at LANL	5–139
5.3.11.6	Worker Accidents	5–139

5.4	IMPACTS OF THE REDUCED OPERATIONS ALTERNATIVE	5–143
5.4.1	Land Resources	5–143
5.4.1.1	Land Use	5–143
5.4.1.2	Visual Resources	5–143
5.4.1.3	Noise	5–143
5.4.2	Geology and Soils	5–143
5.4.3	Water Resources	5–143
5.4.3.1	Surface Water	5–143
5.4.3.2	Alluvial Groundwater	5–143
5.4.3.3	Perched Groundwater	5–144
5.4.3.4	Main Aquifer	5–144
5.4.4	Air Quality	5–145
5.4.4.1	Nonradiological Air Quality Impacts	5–145
5.4.4.2	Radiological Air Quality Impacts	5–146
5.4.5	Ecological Resources, Biodiversity, and Ecological Risk	5–147
5.4.6	Human Health	5–147
5.4.6.1	Public Health	5–147
5.4.6.2	Worker Health	5–151
5.4.7	Environmental Justice	5–153
5.4.8	Cultural Resources	5–155
5.4.9	Socioeconomics, Infrastructure, and Waste Management	5–155
5.4.9.1	Socioeconomic Impacts	5–155
5.4.9.2	Infrastructure Impacts	5–157
5.4.9.3	Waste Management	5–158
5.4.9.4	Contaminated Space	5–158
5.4.10	Transportation	5–158
5.4.10.1	Vehicle-Related Risks	5–158
5.4.10.2	Cargo-Related Risks	5–161
5.4.11	Accident Analysis	5–164
5.4.11.1	Multiple Source Release of Hazardous Material from Site-Wide Earthquake and Wildfire	5–164
5.4.11.2	Plutonium Releases from Manmade and Process Hazards at LANL	5–166
5.4.11.3	Highly Enriched Uranium Release from Process Hazard Accident	5–166
5.4.11.4	Tritium Release from a Manmade Hazard Accident at LANL	5–166
5.4.11.5	Chemical Releases from Manmade and Process Hazard Accidents at LANL	5–166

5.4.11.6	Worker Accidents	5-166
5.5	IMPACTS OF THE GREENER ALTERNATIVE.....	5-169
5.5.1	Land Resources	5-169
5.5.1.1	Land Use	5-169
5.5.1.2	Visual Resources	5-169
5.5.1.3	Noise	5-169
5.5.2	Geology and Soils	5-169
5.5.3	Water Resources	5-169
5.5.3.1	Surface Water	5-169
5.5.3.2	Alluvial Groundwater	5-169
5.5.3.3	Perched Groundwater	5-170
5.5.3.4	Main Aquifer	5-170
5.5.4	Air Quality	5-171
5.5.4.1	Nonradiological Air Quality Impacts	5-171
5.5.4.2	Radiological Air Quality Impacts	5-172
5.5.5	Ecological Resources, Biodiversity, and Ecological Risk.....	5-173
5.5.6	Human Health	5-173
5.5.6.1	Public Health	5-173
5.5.6.2	Worker Health	5-177
5.5.7	Environmental Justice	5-179
5.5.8	Cultural Resources.....	5-181
5.5.9	Socioeconomics, Infrastructure, and Waste Management.....	5-181
5.5.9.1	Socioeconomic Impacts.....	5-181
5.5.9.2	Infrastructure Impacts	5-183
5.5.9.3	Waste Management	5-184
5.5.9.4	Contaminated Space	5-184
5.5.10	Transportation	5-184
5.5.10.1	Vehicle-Related Risks	5-184
5.5.10.2	Cargo-Related Risks	5-187
5.5.11	Accident Analysis	5-190
5.5.11.1	Multiple Source Release of Hazardous Material from Site-Wide Earthquake and Wildfire.....	5-190
5.5.11.2	Plutonium Releases from Manmade and Process Hazards at LANL.....	5-190
5.5.11.3	Highly Enriched Uranium Release from Process Hazard Accident at LANL	5-192
5.5.11.4	Tritium Release from a Manmade Hazard.....	5-192
5.5.11.5	Chemical Releases from Manmade and Process Hazard Accidents at LANL	5-192

5.5.11.6	Worker Accidents at LANL.....	5-192
5.6	CUMULATIVE AND UNAVOIDABLE IMPACTS	5-193
5.6.1	Cumulative Impacts	5-193
5.6.1.1	Land Use	5-193
5.6.1.2	Water Resources	5-194
5.6.1.3	Air Quality	5-194
5.6.1.4	Ecological Resources.....	5-195
5.6.1.5	Cultural Resources.....	5-196
5.6.1.6	Socioeconomics	5-196
5.6.1.7	Infrastructure	5-196
5.6.1.8	Transportation	5-198
5.6.1.9	Human Health	5-199
5.6.2	Unavoidable Adverse Impacts.....	5-199
5.6.3	Irreversible and Irretrievable Commitments of Resources	5-199
5.6.4	Relationship Between Local Short-Term Uses of the Environment and the Maintenance and Enhancement of Long-Term Productivity	5-200
REFERENCES	5-202

CHAPTER 6.0

MITIGATION MEASURES	6-1
6.1	MITIGATION MEASURES INCLUDED IN THE SWEIS ALTERNATIVES..... 6-1
6.1.1	Existing Programs and Controls
6.1.2	Specific Mitigation Measures Incorporated in the SWEIS Alternatives.....
6.2	OTHER MITIGATION MEASURES CONSIDERED..... 6-5
REFERENCES 6-7

CHAPTER 7.0

APPLICABLE LAWS, REGULATIONS, AND OTHER REQUIREMENTS	7-1
7.0	INTRODUCTION..... 7-1
7.1	DOE REGULATORY AUTHORITIES FOR ENVIRONMENT, SAFETY AND HEALTH
7.1.1	Atomic Energy Act of 1954..... 7-2
7.1.1.1	DOE Order 451.1A, National Environmental Policy Act Compliance Program
7.1.1.2	DOE Order 5400.1, General Environmental Protection Program

7.1.1.3	DOE Order 5400.5, Radiation Protection of the Public and Environment	7-3
7.1.1.4	DOE Order 5820.2A, Radioactive Waste Management	7-3
7.2	LAWS, REGULATIONS AND EXECUTIVE ORDERS RELATED TO ENVIRONMENTAL PLANNING AND CONSULTATION	7-4
7.2.1	National Environmental Policy Act of 1969, as Amended and Executive Order 11514, as Amended by Executive Order 11991	7-4
7.2.2	Endangered Species Act, as Amended, and Related Requirements	7-5
7.2.3	National Historic Preservation Act, as Amended	7-5
7.2.4	National Historic Preservation, Executive Order 11593	7-6
7.2.5	American Indian Religious Freedom Act of 1978.	7-6
7.2.6	Native American Graves Protection and Repatriation Act of 1990.	7-6
7.2.7	Archaeological Resource Protection Act, as Amended	7-7
7.2.8	Indian Sacred Sites, Executive Order 13007	7-7
7.2.9	Pueblo Accords	7-7
7.2.10	Protection of Wetlands, Executive Order 11990, and Floodplain Management, Executive Order 11988	7-8
7.2.11	Environmental Justice, Executive Order 12898	7-8
7.2.12	New Mexico Environmental Oversight and Monitoring Agreement	7-8
7.2.13	Recreational Fisheries, Executive Order 12962	7-8
7.2.14	Migratory Bird Treaty Act.	7-9
7.3	LAWS, REGULATIONS, AND EXECUTIVE ORDERS RELATED TO REGULATORY ENVIRONMENTAL PROTECTION AND COMPLIANCE	7-9
7.4	AIR RESOURCES	7-10
7.4.1	Clean Air Act, as Amended	7-10
7.4.2	New Mexico Air Quality Control Act	7-11
7.4.2.1	Construction Permits	7-11
7.4.2.2	Operating Permits	7-12
7.4.2.3	Prevention of Significant Deterioration.	7-12
7.4.2.4	Emission Standards for Hazardous Air Pollutants.	7-12
7.4.3	Noise Control Act of 1972.	7-13
7.5	WATER RESOURCES	7-13
7.5.1	Clean Water Act, as Amended.	7-13
7.5.1.1	National Pollutant Discharge Elimination System Permit Program/Liquid Radioactive Discharges	7-14
7.5.1.2	Unplanned Discharges, Spills, and Releases	7-15
7.5.1.3	Spill Prevention Control and Countermeasure Plan	7-16
7.5.1.4	Sanitary Sewage Sludge Management Program	7-16

7.5.1.5	Safe Drinking Water Act, as Amended	7-16
7.5.1.6	Groundwater Protection Requirements	7-17
7.6	LAND RESOURCES (WASTE MANAGEMENT, TOXIC SUBSTANCES, POLLUTION PREVENTION, AND ENVIRONMENTAL RESTORATION)	7-18
7.6.1	Resource Conservation and Recovery Act	7-18
7.6.2	Radioactive Waste Management Requirements	7-20
7.6.3	Federal Facility Compliance Act	7-21
7.6.4	Underground Storage Tanks, RCRA Subtitle I	7-22
7.6.5	Comprehensive Environmental Response, Compensation, and Liability Act, as Amended	7-22
7.6.6	Toxic Substances Control Act	7-23
7.6.7	Hazardous Materials Transportation Act	7-24
7.6.8	Federal Insecticide, Fungicide, and Rodenticide Act	7-24
7.6.9	Pollution Prevention Act of 1990	7-25
7.7	COMMUNITY RIGHT-TO-KNOW AND EMERGENCY PLANNING	7-25
7.7.1	Emergency Planning and Community Right-to-Know Act and Executive Order 12856	7-25
	APPENDIX 7.A CONSULTATIONS	7-27
	REFERENCES	7-29

CHAPTER 8
LIST OF PREPARERS 8-1

CHAPTER 9.0
LIST OF AGENCIES, ORGANIZATIONS,
AND INDIVIDUALS TO WHOM COPIES OF
THIS SWEIS HAVE BEEN SENT 9-1

CHAPTER 10.0
GLOSSARY 10-1

CHAPTER 11.0
CONTRACTOR DISCLOSURE STATEMENTS 11-1

CHAPTER 12
INDEX 12-1

**OTHER PARTS OF THIS SWEIS
(BOUND SEPARATELY FROM THIS VOLUME):**

SUMMARY

**VOLUME II
PROJECT-SPECIFIC SITING AND CONSTRUCTION ANALYSES**

**VOLUME III
APPENDIXES (2 PARTS)**

**VOLUME IV
COMMENT RESPONSE DOCUMENT**

VOLUME I

LIST OF FIGURES

FIGURE 1–1	Location of the Los Alamos National Laboratory.....	1–2
FIGURE 2.1.2.2–1	Gross Space Utilization by Function.....	2–7
FIGURE 2.1.2.5–1	Geographic Locations of the Operable Units.	2–11
FIGURE 2.2.1–1	Technical Areas of Los Alamos National Laboratory.....	2–19
FIGURE 2.2.2–1	Key Facility Locations Within LANL.....	2–25
FIGURE 2.2.2.1–1	TA–55 Plutonium Facility Complex.	2–26
FIGURE 2.2.2.2–1	TA–16 Tritium Facilities (WETF).....	2–34
FIGURE 2.2.2.2–2	TA–21 Tritium Facilities (TSTA and TSFF).....	2–35
FIGURE 2.2.2.3–1	TA–3 Chemistry and Metallurgy Research Building.	2–39
FIGURE 2.2.2.4–1	TA–18 Pajarito Site.	2–47
FIGURE 2.2.2.5–1	The Sigma Complex in TA–3.	2–51
FIGURE 2.2.2.6–1	Materials Science Laboratory.	2–54
FIGURE 2.2.2.7–1	Target Fabrication Facility.....	2–57
FIGURE 2.2.2.8–1	Main Machine Shops.....	2–59
FIGURE 2.2.2.9–1	TA–8 High Explosives Processing.	2–61
FIGURE 2.2.2.9–2	TA–9 High Explosives Processing.	2–62
FIGURE 2.2.2.9–3	TA–11 High Explosives Processing.	2–63
FIGURE 2.2.2.9–4	TA–16 High Explosives Processing.	2–64
FIGURE 2.2.2.9–5	TA–16 West High Explosives Processing.....	2–65
FIGURE 2.2.2.9–6	TA–16 East High Explosives Processing.	2–66
FIGURE 2.2.2.9–7	TA–28 High Explosives Processing.	2–67

FIGURE 2.2.2.9–8	TA–37 High Explosives Processing.	2–68
FIGURE 2.2.2.9–9	TA–22 Los Alamos Detonator Facility.	2–72
FIGURE 2.2.2.10–1	TA–14 High Explosives Testing.	2–74
FIGURE 2.2.2.10–2	TA–15 West High Explosives Testing.	2–75
FIGURE 2.2.2.10–3	TA–15 Central High Explosives Testing.	2–76
FIGURE 2.2.2.10–4	TA–15 East and TA–36 West High Explosives Testing.	2–77
FIGURE 2.2.2.10–5	TA–36 East High Explosives Testing.	2–78
FIGURE 2.2.2.10–6	TA–39 High Explosives Testing.	2–79
FIGURE 2.2.2.10–7	TA–40 East High Explosives Testing.	2–80
FIGURE 2.2.2.11–1	TA–53 Los Alamos Neutron Science Center.	2–85
FIGURE 2.2.2.11–2	TA–53 Los Alamos Neutron Science Center West.	2–86
FIGURE 2.2.2.11–3	TA–53 Los Alamos Neutron Science Center East.	2–87
FIGURE 2.2.2.12–1	TA–43 Health Research Laboratory.	2–93
FIGURE 2.2.2.13–1	TA–48 Radiochemistry Facility.	2–96
FIGURE 2.2.2.14–1	TA–50 Radioactive Liquid Waste Treatment Facility.	2–100
FIGURE 2.2.2.15–1	TA–50 Solid Radioactive and Chemical Waste Facilities.	2–104
FIGURE 2.2.2.15–2	TA–54 Solid Radioactive and Chemical Waste Facilities.	2–105
FIGURE 2.2.2.15–3	TA–54 Solid Radioactive and Chemical Waste Facilities.	2–106
FIGURE 2.2.2.15–4	TA–54 Solid Radioactive and Chemical Waste Facilities.	2–107
FIGURE 2.2.2.15–5	TA–54 Area G Disposal Cells.	2–111
FIGURE 4.0–1	Location of LANL.	4–2
FIGURE 4.1.1–1	Land Stewardship in the LANL Area.	4–5
FIGURE 4.1.1.2–1	Land Use Within LANL Boundaries.	4–8
FIGURE 4.1.1.5–1	Santa Fe National Forest Management Areas.	4–11

FIGURE 4.2–1	Geology of the LANL Region.	4–23
FIGURE 4.2.1–1	Stratigraphic Units and Structure of the LANL Area.	4–26
FIGURE 4.2.2.2–1	Major Surface Faults at LANL.	4–28
FIGURE 4.2.3.1–1	On-Site and Off-Site Perimeter Soil Sampling Locations.	4–36
FIGURE 4.2.3.1–2	Regional Soil Sampling Locations.	4–37
FIGURE 4.3–1	Conceptual Sketch of Groundwater Flow Paths in the Española Portion of the Northern Rio Grande Basin.	4–44
FIGURE 4.3–2	Conceptual Geohydrological Drawing of the Pajarito Plateau.	4–45
FIGURE 4.3.1–1	Watersheds in the LANL Region.	4–48
FIGURE 4.3.1.1–1	Regional Surface Water and Sediment Sampling Locations.	4–49
FIGURE 4.3.1.1–2	On-Site and Perimeter Surface Water Sampling Locations.	4–50
FIGURE 4.3.1.3–1	Stream Reaches and NPDES Outfall Locations.	4–58
FIGURE 4.3.1.4–1	On-Site and Off-Site Perimeter Sediment Sampling Locations.	4–64
FIGURE 4.3.1.4–2	Plutonium Concentrations and Likely Sources.	4–67
FIGURE 4.3.1.5–1	Tritium and Plutonium Activity at Mortandad Canyon at Gaging Station 1.a	4–69
FIGURE 4.3.2–1	Springs in the LANL Area.	4–71
FIGURE 4.3.2.1–1	Observation Wells and Springs Used for Alluvial and Intermediate Groundwater Sampling.	4–73
FIGURE 4.3.2.1–2	Regional Aquifer Test Wells, Supply Wells, Springs, and Water Level Contours	4–74
FIGURE 4.3.2.4–1	Approximate Aquifer Water Level Decline from 1949–1950 to 1993. . . .	4–80
FIGURE 4.4.1–1	LANL Meteorological Stations.	4–84
FIGURE 4.4.1–2	Mean High and Low Temperatures for Los Alamos (1961 to 1990) and White Rock (1965 to 1990).	4–85
FIGURE 4.4.1–3	Mean Precipitation for Los Alamos (1961 to 1990) and White Rock (1965 to 1990).	4–85

FIGURE 4.4.1.1-1	LANL Meteorological Stations with Associated Wind Rose Data.	4-87
FIGURE 4.5.1.1-1	LANL Technical Areas and Watersheds.	4-97
FIGURE 4.5.1.1-2	LANL Technical Areas and Watersheds with Vegetation Zones.	4-99
FIGURE 4.5.1.2-1	LANL Technical Areas and Watersheds with Wetland Locations.	4-108
FIGURE 4.6.1.1-1	Total Contributions to 1996 Dose for LANL's Maximally Exposed Individual.	4-130
FIGURE 4.6.1.1-2	LANL's Contribution to Dose by Pathway for LANL's Maximally Exposed Individual.	4-131
FIGURE 4.7.1-1	Sectors Used for Environmental Justice Analysis Within 50 Miles (80 Kilometers) of LANL.	4-152
FIGURE 4.7.1-2	Sectors with Minority and Low-Income Populations Greater Than 25 Percent of the Sector Population.	4-153
FIGURE 4.8-1	Pueblos and Reservations in the LANL Region.	4-158
FIGURE 4.9.1.6-1	University of California Procurement in New Mexico Counties, Fiscal Year 1995.	4-171
FIGURE 4.9.2.1-1	Los Alamos Area Natural Gas Distribution System.	4-180
FIGURE 4.9.2.1-2	Los Alamos Area Electrical Power Distribution System.	4-182
FIGURE 4.9.2.1-3	Los Alamos Area Water Distribution System.	4-185
FIGURE 4.10.1-1	Regional Transportation Map.	4-196
FIGURE 5.1.10-1	Transportation Risk Analysis Methodology.	5-19
FIGURE 5.2.4.2-1	Isodose Map Showing Doses Greater Than 1 Millirem per Year for the No Action Alternative.	5-52
FIGURE 5.2.4.2-2	Isodose Map Showing Doses Less Than 1 Millirem per Year for the No Action Alternative.	5-53
FIGURE 5.2.7-1	Isodose Lines from Airborne Releases for the No Action Alternative Within 50 Miles (80 Kilometers) of LANL.	5-70
FIGURE 5.3.4.2-1	Isodose Map Showing Doses Greater Than 1 Millirem per Year for the Expanded Operations Alternative.	5-110

FIGURE 5.3.4.2-2	Isodose Map Showing Doses Less Than 1 Millirem per Year for the Expanded Operations Alternative.	5-111
FIGURE 5.3.7-1	Isodose Lines from Airborne Releases for the Expanded Operations Alternative Within 50 Miles (80 Kilometers) of LANL.	5-121
FIGURE 5.4.4.2-1	Isodose Map Showing Doses Greater Than 1 Millirem per Year for the Reduced Operations Alternative.	5-148
FIGURE 5.4.4.2-2	Isodose Map Showing Doses Less Than 1 Millirem per Year for the Reduced Operations Alternative.	5-149
FIGURE 5.4.7-1	Isodose Lines from Airborne Releases for the Reduced Operations Alternative Within 50 Miles (80 Kilometers) of LANL.	5-154
FIGURE 5.5.4.2-1	Isodose Map Showing Doses Greater Than 1 Millirem per Year for the Greener Alternative.	5-174
FIGURE 5.5.4.2-2	Isodose Map Showing Doses Less Than 1 Millirem per Year for the Greener Alternative.	5-175
FIGURE 5.5.7-1	Isodose Lines from Airborne Releases for the Greener Alternative Within 50 Miles (80 Kilometers) of LANL.	5-180
FIGURE 7.5.1.1-1	National Pollutant Discharge Elimination System Permit Exceedances. . .	7-15
FIGURE 7.5.1.1-2	Liquid Release Notifications.	7-16

VOLUME I

LIST OF TABLES

TABLE 1.1.5-1	Primary Laboratory Performers for DOE Missions	1-11
TABLE 2.1.2.5-1	Summary of Environmental Restoration Project Field Units, Technical Areas, Operable Units, Potential Contaminants, and Waste Types Generated During Characterization/Remediation	2-12
TABLE 2.1.2.5-2	Major Decommissioning Activities Completed to Date at LANL	2-13
TABLE 2.1.2.5-3	Future Decommissioning Activities at LANL	2-13
TABLE 2.2-1	Number of Nuclear and Moderate/Low Hazard Facilities at LANL by Technical Area	2-18
TABLE 2.2.1-1	Overview of Technical Areas and Their Associated Activities	2-20
TABLE 2.2.2-1	Identification of Key Facilities for Analysis of LANL Operations	2-24
TABLE 2.2.2.1-1	Principal Buildings and Structures of the Plutonium Facility Complex (TA-55)	2-27
TABLE 2.2.2.2-1	Principal Buildings and Structures of the Tritium Facilities	2-33
TABLE 2.2.2.3-1	Principal Buildings and Structures in the Chemical and Metallurgy Research Building.	2-38
TABLE 2.2.2.3-2	CMR Building Upgrades Project Crosswalk Between Phases I and II and 1998 Scope of Work Authorized or Under Review	2-44
TABLE 2.2.2.4-1	Principal Buildings and Structures of the Pajarito Site	2-48
TABLE 2.2.2.5-1	Principal Structures and Buildings in the Sigma Complex	2-50
TABLE 2.2.2.6-1	Principal Buildings and Structures of Materials Science Laboratory	2-53
TABLE 2.2.2.7-1	Principal Buildings and Structures of Target Fabrication Facility	2-56
TABLE 2.2.2.8-1	Principal Buildings and Structures of Main Machine Shops	2-58
TABLE 2.2.2.9-1	High Explosives Processing Facilities: Identification of Principal Buildings/Structures	2-69
TABLE 2.2.2.10-1	Principal Buildings and Structures of High Explosives Testing Facilities	2-81

TABLE 2.2.2.11-1	Principal Buildings and Structures of Los Alamos Neutron Science Center	2-88
TABLE 2.2.2.12-1	Principal Buildings and Structures of the Health Research Laboratory	2-92
TABLE 2.2.2.13-1	Principal Buildings and Structures of the Radiochemistry Facility	2-95
TABLE 2.2.2.14-1	Principal Buildings and Structures of the Radioactive Liquid Waste Treatment Facility	2-99
TABLE 2.2.2.15-1	Principal Buildings and Structures of the Solid Radioactive and Chemical Waste Facilities	2-108
TABLE 2.4-1	LANL Consolidated Funding Summary (Fiscal Year 1994 to Fiscal Year 1998)	2-119
TABLE 3.6.1-1	Alternatives for Continued Operation of TA-55 Plutonium Facility Complex	3-71
TABLE 3.6.1-2	Parameter Differences Among Alternatives for Continued Operation of the Plutonium Facility Complex (TA-55)	3-74
TABLE 3.6.1-3	Alternatives for Continued Operation of Tritium Facilities	3-75
TABLE 3.6.1-4	Parameter Differences Among Alternatives for Continued Operation of the Tritium Facilities (TA-16 and TA-21)	3-77
TABLE 3.6.1-5	Alternatives for Continued Operation of the Chemistry and Metallurgy Research Building (TA-3)	3-79
TABLE 3.6.1-6	Parameter Differences Among Alternatives for Continued Operation of the Chemistry and Metallurgy Research Building (TA-3)	3-82
TABLE 3.6.1-7	Alternatives for Continued Operations of Pajarito Site (TA-18)	3-83
TABLE 3.6.1-8	Parameter Differences Among Alternatives for Continued Operation of the Pajarito Site, (TA-18)	3-85
TABLE 3.6.1-9	Alternatives for Continued Operation of Sigma Complex	3-86
TABLE 3.6.1-10	Parameter Differences Among Alternatives for Continued Operation of the Sigma Complex (TA-3)	3-88
TABLE 3.6.1-11	Alternatives for Continued Operation of the Materials Science Laboratory (TA-3-1698)	3-89

TABLE 3.6.1-12	Parameter Differences Among Alternatives for Continued Operation of the Material Science Laboratory (TA-3)	3-90
TABLE 3.6.1-13	Alternatives for Continued Operation of the Target Fabrication Facility (TA-35)	3-91
TABLE 3.6.1-14	Parameter Differences Among Alternatives for Continued Operation of the Target Fabrication Facility (TA-35)	3-92
TABLE 3.6.1-15	Alternatives for Continued Operation of the Machine Shops, TA-3	3-93
TABLE 3.6.1-16	Parameter Differences Among Alternatives for Continued Operation of the Machine Shops (TA-3)	3-94
TABLE 3.6.1-17	Alternatives for the Continued Operation of the High Explosives Processing Facilities (TA-8, TA-9, TA-11, TA-16, TA-22, TA-29, and TA-37)	3-95
TABLE 3.6.1-18	Parameter Differences Among Alternatives for Continued Operation of High Explosives Processing (TA-8, TA-9, TA-11, TA-16, TA-22, TA-28, and TA-37)	3-97
TABLE 3.6.1-19	Alternatives for the Continued Operation of High Explosives Testing: TA-14 (Q-Site), TA-15 (R-Site), TA-36 (Kappa-Site), TA-39 (Ancho Canyon Site), and TA-40 (DF-Site)	3-99
TABLE 3.6.1-20	Parameter Differences Among Alternatives for Continued Operation of High Explosives Testing, TA-14 (Q-Site) TA-15 (R-Site) TA-36 (Kappa Site), and TA-40 (DF-Site)	3-100
TABLE 3.6.1-21	Alternatives for Continued Operation of the Los Alamos Neutron Science Center (TA-53)	3-103
TABLE 3.6.1-22	Parameter Differences Among Alternatives for Continued Operation of the Los Alamos Neutron Science Center (TA-53)	3-107
TABLE 3.6.1-23	Alternatives for the Continued Operation of the Health Research Laboratory (TA-43)	3-110
TABLE 3.6.1-24	Parameter Differences in Alternatives for Continued Operation of the Health Research Laboratory (TA-43)	3-112
TABLE 3.6.1-25	Alternatives for Continued Operation of the Radiochemistry Facility (TA-48)	3-113
TABLE 3.6.1-26	Parameter Differences Among Alternatives for Continued Operation of the Radiochemistry Site TA-48)	3-115

TABLE 3.6.1–27	Alternatives for Continued Operation of the Radioactive Liquid Waste Treatment Facility (TA–50)	3–117
TABLE 3.6.1–28	Parameter Differences Among Alternatives for Continued Operations of the Radioactive Liquid Waste Treatment Facility (TA–50)	3–119
TABLE 3.6.1–29	Alternatives for Continued Operation of the Solid Radioactive and Chemical Waste Facilities (TA–54 and TA–50)	3–120
TABLE 3.6.1–30	Parameter Differences Among Alternatives for Continued Operation of the Solid Radioactive and Chemical Waste Facilities (TA–54 and TA–50)	3–124
TABLE 3.6.1–31	Parameters for LANL Activities Other Than Those at the Key Facilities	3–125
TABLE 3.6.2–1	Comparison of Potential Consequences of Continued Operations of LANL: Normal Operations	3–126
TABLE 3.6.2–2	Comparison of Potential Consequences of Continued Operations of LANL: Accidents	3–136
TABLE 4.1.1.1–1	Land Stewards Within Los Alamos County	4–4
TABLE 4.1.1.2–1	LANL General Land Use	4–9
TABLE 4.1.1.3–1	Los Alamos County (Excluding LANL) Land Use Definitions	4–9
TABLE 4.1.1.5–1	Santa Fe National Forest Management Areas	4–12
TABLE 4.1.3.1–1	Limiting Values for Average Daily Noise Exposure	4–18
TABLE 4.1.3.1–2	Occupational Exposure Limits for Impulse/Impact Noise	4–19
TABLE 4.2.1–1	Characteristics of the Major Stratigraphic Units in the LANL Region	4–24
TABLE 4.2.2.2–1	Summary of Major Faults	4–29
TABLE 4.2.2.2–2	Summary of Ongoing Geologic Field Studies	4–30
TABLE 4.2.2.2–3	Correlations Among Observed Effects of Earthquakes, Richter Magnitudes, and Peak Ground Acceleration	4–32
TABLE 4.2.2.2–4	Peak Horizontal Ground Accelerations Corresponding to Return Periods from 500 to 10,000 Years for Eight LANL Technical Areas	4–33

TABLE 4.2.3.1-1	Regional Statistical Reference Level and LANL Screening Action Levels for Radionuclides	4-38
TABLE 4.3-1	Summary of Water Resources and Sampling Locations by Watershed . .	4-46
TABLE 4.3.1.1-1	Summary of Discharges from Stream Monitoring Stations at LANL, Water Year 1995 (October 1, 1994 Through September 30, 1995)	4-51
TABLE 4.3.1.3-1	NPDES Outfalls by Watershed	4-54
TABLE 4.3.1.3-2	LANL NPDES Discharge Limits (Daily Average/Daily Maximum) . . .	4-60
TABLE 4.3.1.3-3	Number of NPDES Violations (1991 Through 1995)	4-62
TABLE 4.4.2.2-1	Combustion Sources at LANL	4-90
TABLE 4.4.2.3-1	Nonradiological Ambient Air Monitoring Results at TA-49 (1991 Through 1994)	4-91
TABLE 4.4.3.3-1	Dose to the MEI from Exposure to LANL Airborne Radionuclide Emissions (1990 Through 1995)	4-93
TABLE 4.4.4-1	Average Visibility Measurements at Bandelier National Monument (1991 to 1994)	4-94
TABLE 4.5.1.1-1	Regional Watershed Summary	4-98
TABLE 4.5.1.1-2	Areal Extent of Major Vegetation Zones by Watershed	4-100
TABLE 4.5.1.1-3	Characteristics of the Major Vegetation Zones in the LANL Area . . .	4-102
TABLE 4.5.1.1-4	Vegetation Zones—Disturbances and Current Ecological Conditions . .	4-104
TABLE 4.5.1.2-1	Regional Watersheds and Wetlands in Association with Los Alamos National Laboratory Outfalls	4-109
TABLE 4.5.1.2-2	Wetlands—Disturbance and Current Ecological Conditions	4-110
TABLE 4.5.1.3-1	Canyons—Disturbance and Current Ecological Conditions	4-110
TABLE 4.5.1.4-1	Rio Grande Disturbance and Current Ecological Conditions	4-112
TABLE 4.5.1.5-1	Protected and Sensitive Species	4-114
TABLE 4.6.1.1-1	Total Effective Dose Equivalent (millirem/year) from Natural or Manmade Sources	4-130

TABLE 4.6.1.1–2	Estimated Dose to Maximally Exposed Members of the Public from LANL Operations for 1996	4–131
TABLE 4.6.1.3–1	All Cancer: All Races, Both Sexes, Age-Adjusted Incidence Rates (1983 Through 1987 and 1988 Through 1991)	4–135
TABLE 4.6.2.1–1	Representative Examples of Recorded Radiological and Chemical Exposures and Physical Accidents Affecting Workers at LANL 1993 Through 1996.	4–139
TABLE 4.6.2.1–2	Total Recordable and Lost Workday Cases Rates at LANL and at Other DOE Facilities (1990 Through 1995)	4–141
TABLE 4.6.2.2–1	Baseline Radiological Exposure to LANL Workers	4–143
TABLE 4.7.1–1	Environmental Justice Areas Within a 50-Mile (80-Kilometer) Radius of LANL	4–154
TABLE 4.8.1–1	Archaeological Periods of Northern New Mexico	4–159
TABLE 4.8.1–2	Prehistoric Site Types and Number of Sites Recorded in the LANL Cultural Resources Database	4–160
TABLE 4.8.2–1	Historic Site Types and Number of Sites Recorded in the LANL Cultural Resources Database	4–161
TABLE 4.8.3–1	Traditional Cultural Properties Identified by Consulting Communities on or near LANL Property	4–163
TABLE 4.9.1.1–1	1990 Population by Race and Ethnicity for the Tri-County Region	4–165
TABLE 4.9.1.1–2	Tri-County Population Projections Through the Year 2006	4–165
TABLE 4.9.1.2–1	Income Data for the LANL Region	4–165
TABLE 4.9.1.3–1	Regional Civilian Labor Force, Employment, Unemployment, and Unemployment Rates (1995)	4–166
TABLE 4.9.1.4–1	Earnings for Tri-County Region (Thousands of Dollars)	4–167
TABLE 4.9.1.5–1	Employees of the LANL-Affiliated Work Force by County of Residence (March 1996)	4–168
TABLE 4.9.1.5–2	LANL-Affiliated Work Force by Race and Ethnicity	4–168
TABLE 4.9.1.5–3	Percentage of University of California Employees by Race/Ethnicity (March 1996)	4–169

TABLE 4.9.1.5–4	Salary and Work Force Shares of University of California Employees by Race/Ethnicity (1986)	4–169
TABLE 4.9.1.6–1	University of California Procurement for Fiscal Years 1993 Through 1995	4–170
TABLE 4.9.1.8–1	Municipal and County General Fund Revenues in the Tri-County Region (Fiscal Year 1995)	4–173
TABLE 4.9.1.8–2	Municipal General Fund Revenues in Tri-County Region (Fiscal Year 1995)	4–174
TABLE 4.9.1.8–3	Rio Arriba and Santa Fe Counties Revenues (Fiscal Year 1995)	4–174
TABLE 4.9.1.8–4	DOE Payments to Los Alamos County (Fiscal Year 1997)	4–175
TABLE 4.9.1.8–5	Public School Statistics in the LANL Region (1995–1996 School Year)	4–176
TABLE 4.9.1.8–6	Regional Housing Summary for the Tri-County Region (1990)	4–177
TABLE 4.9.2.1–1	Gas Consumption (Decatherms) at LANL (Fiscal Years 1991 to 1995)	4–181
TABLE 4.9.2.1–2	Electric Peak Coincidental Demand (Kilowatt) (Fiscal Years 1991 to 1995)	4–183
TABLE 4.9.2.1–3	Electric Consumption (Megawatthour) (Fiscal Years 1991 to 1995) . . .	4–183
TABLE 4.9.3.3–1	Historical Waste Generation Ranges and Annual Baseline Generation Rates at LANL (1990 Through 1995)	4–189
TABLE 4.9.4–1	Estimated Existing Contaminated Space in LANL Facilities	4–193
TABLE 4.10.1–1	Traffic for Selected Highway Segments in the Vicinity of LANL	4–198
TABLE 4.10.2–1	Accidents Within Los Alamos County (1990 Through 1994)	4–199
TABLE 4.10.2–2	Truck Accident Rates in the Santa Fe to Los Alamos Area (1990 Through 1994)	4–199
TABLE 4.10.3.1–1	Annual LANL On-Site and Off-Site Shipments	4–200
TABLE 4.10.3.2–1	Summary of Off-Site, Unclassified Radioactive and Hazardous Materials Shipments (1990 Through 1994)	4–201
TABLE 5.1.4.1–1	Guideline Values Applied in the Nonradiological Air Quality Analysis . .	5–7

TABLE 5.1.4.2–1	Facilities Modeled for Radionuclide Air Emissions	5–8
TABLE 5.1.11.1–1	SWEIS Accident Analysis Facility Listing	5–25
TABLE 5.1.11.7–1	Dominant Accidents at LANL	5–31
TABLE 5.1.11.7–2	Incredible Accidents That Were Analyzed	5–32
TABLE 5.1.11.9–1	Dominant Worker Accidents at LANL	5–35
TABLE 5.2.3.1–1	NPDES Discharges by Watershed Under the No Action Alternative	5–42
TABLE 5.2.3.1–2	TA–50 Radionuclide Summary	5–43
TABLE 5.2.3.1–3	Maximum Water Level Changes at the Top of the Main Aquifer Under the No Action Alternative (1997 Through 2006)	5–48
TABLE 5.2.4.2–1	Facility-Specific Maximally Exposed Individual Information—No Action Alternative	5–50
TABLE 5.2.6.1–1	Estimated Public Health Consequences for LANL Maximally Exposed Individual and the Population Within 50-Mile (80-Kilometer) Radius of LANL for the No Action Alternative	5–58
TABLE 5.2.6.1–2	Average Public Radiological Dose and Potential Consequences by Ingestion Pathways, All Alternatives	5–61
TABLE 5.2.6.1–3	Worst-Case Public Radiological Dose and Potential Consequences by Ingestion Pathways, All Alternatives	5–63
TABLE 5.2.6.1–4	Metals Exposure and Risk via Ingestion Pathways and Hypothetical Receptors Used to Evaluate Potential Public Health Consequence, All Alternatives	5–65
TABLE 5.2.6.1–5	Radiation Doses and Excess LCF Risks Estimated to the Public at Stops During Transportation of Materials from LANL	5–67
TABLE 5.2.6.2–1	Worker Ionizing Radiation Annual Doses and Associated Lifetime Excess LCF Risks Under the No Action Alternative	5–68
TABLE 5.2.6.2–2	Projected Annual Reportable Worker Accidents and Injuries for Normal Operations in the No Action Alternative Compared with the Index Period	5–69
TABLE 5.2.8–1	Projected Impacts to Prehistoric Resources, Historic Resources, and TCPs Under the No Action Alternative	5–72

TABLE 5.2.9.1-1	Summary of Primary LANL Employment, Salaries, and Procurement Under the No Action Alternative	5-76
TABLE 5.2.9.1-2	Summary of Total Tri-County Employment, Salaries, Business Activity, and Population Changes Under the No Action Alternative	5-76
TABLE 5.2.9.1-3	Construction Spending, Labor Salaries, and Labor Employment Numbers Under the No Action Alternative (Fiscal Year 1997 Through 2006)	5-77
TABLE 5.2.9.3-1	Projected Annual and 10-Year Total Waste Generation Under the No Action Alternative	5-79
TABLE 5.2.10.1-1	Truck Accident Injuries and Fatalities Projected for LANL Shipments Under the No Action Alternative	5-80
TABLE 5.2.10.2-1	Incident-Free Population Dose and Lifetime Excess LCFs for Off-Site Shipments per Year of Operation Under the No Action Alternative	5-81
TABLE 5.2.10.2-2	MEI Doses and Associated Frequencies for Off-Site Radioactive Materials Accidents	5-82
TABLE 5.2.10.2-3	Bounding Radioactive Materials Off-Site Accident Population Risk for the No Action Alternative	5-82
TABLE 5.2.10.2-4	MEI Doses and Frequencies for Bounding On-Site Radioactive Materials Accidents Under the No Action Alternative	5-83
TABLE 5.2.10.2-5	Frequencies, Consequences, and Risk for a Major Chlorine Accident Under the No Action Alternative	5-85
TABLE 5.2.10.2-6	Frequencies, Consequences, and Risk for a Major Propane Accident Under the No Action Alternative	5-85
TABLE 5.2.11.1-1	Summary of Radiological Risks from Earthquake-Initiated and Wildfire Accident Scenarios at LANL—No Action Alternative	5-87
TABLE 5.2.11.1-2	Summary of Chemical Exposure Risks from Site-Wide Accident Scenarios at LANL—No Action Alternative	5-88
TABLE 5.2.11.2-1	Summary of Radiological Consequences for Plutonium Release Scenarios at LANL—No Action Alternative	5-91

TABLE 5.2.11.3–1	Summary of Radiological Consequences from Highly Enriched Uranium Release Scenarios at LANL—No Action Alternative	5–93
TABLE 5.2.11.4–1	Summary of Radiological Consequences from Tritium Release Scenarios at LANL—No Action Alternative	5–94
TABLE 5.2.11.5–1	Summary of Chlorine Exposure Scenarios at LANL—No Action Alternative	5–95
TABLE 5.2.11.5–2	Summary of Chemical Exposure Scenarios—No Action Alternative	5–96
TABLE 5.2.11.6–1	Summary of Worker Accident Scenarios at LANL—No Action Alternative	5–96
TABLE 5.2.11.6–2	Summary of Consequences to Workers at Origination Facilities for Accident Scenarios	5–97
TABLE 5.3.3.1–1	NPDES Discharges by Watershed Under the Expanded Operations Alternative	5–103
TABLE 5.3.3.4–1	Maximum Water Level Changes at the Top of the Main Aquifer Under the Expanded Operations Alternative (1997 Through 2006)	5–106
TABLE 5.3.4.1–1	Results of Criteria Pollutants Analysis (Expanded Operations Alternative)	5–108
TABLE 5.3.4.2–1	Facility-Specific Information—Expanded Operations Alternative	5–109
TABLE 5.3.6.1–1	Estimated Public Health Consequences for LANL MEI and the Population Within a 50-Mile (80-Kilometer) Radius of LANL for the Expanded Operations Alternative	5–115
TABLE 5.3.6.1–2	Radiation Doses and Excess LCF Risks Estimated to the Public at Stops During Transportation of Materials and Wastes from LANL Under the Expanded Operations Alternative	5–118
TABLE 5.3.6.2–1	Annual Worker Doses and Associated Lifetime Excess LCF Risks Under the Expanded Operations Alternative	5–118
TABLE 5.3.6.2–2	Projected Annual Reportable Accidents and Injuries for the Expanded Operations Alternative Compared with the Index Period	5–119
TABLE 5.3.8–1	Projected Impacts to Prehistoric Resources, Historic Resources, and Traditional Cultural Properties Under the Expanded Operations Alternative	5–123

TABLE 5.3.9.1-1	Summary of Primary LANL Employment, Salaries, and Procurement Under the Expanded Operations Alternative	5-125
TABLE 5.3.9.1-2	Summary of Total Tri-County Employment, Salaries, Business Activity, and Population Changes Under the Expanded Operations Alternative	5-126
TABLE 5.3.9.1-3	Construction Spending, Labor Salaries, and Labor Employment Numbers Under the Expanded Operations Alternative (Fiscal Year 1997 Through 2006)	5-126
TABLE 5.3.9.3-1	Projected Annual and 10-Year Total Waste Generation Under the Expanded Operations Alternative	5-129
TABLE 5.3.10.1-1	Truck Accident Injuries and Fatalities Projected for LANL Shipments Under the Expanded Operations Alternative	5-132
TABLE 5.3.10.2-1	Incident-Free Population Dose and Lifetime Excess LCFs for Off-Site Shipments per Year of Operation Under the Expanded Operations Alternative	5-132
TABLE 5.3.10.2-2	Bounding Radioactive Materials Off-Site Accident Population Risk for the Expanded Operations Alternative	5-133
TABLE 5.3.10.2-3	MEI Doses and Frequencies for Bounding On-Site Radioactive Materials Accidents Under the Expanded Operations Alternative	5-134
TABLE 5.3.10.2-4	Frequencies, Consequences, and Risk for a Major Chlorine Accident Under the Expanded Operations Alternative	5-135
TABLE 5.3.10.2-5	Frequencies, Consequences, and Risk for a Major Propane Accident Under the Expanded Operations Alternative	5-135
TABLE 5.3.11.2-1	Summary of Radiological Consequences for Plutonium Release Scenarios at LANL—Expanded Operations Alternative	5-137
TABLE 5.3.11.3-1	Summary of Radiological Consequences from Highly Enriched Uranium Release Scenarios at LANL—Expanded Operations Alternative	5-140
TABLE 5.3.11.5-1	Summary of Chlorine Exposure Scenarios at LANL—Expanded Operations Alternative	5-141
TABLE 5.3.11.5-2	Summary of Chemical Exposure Scenarios—Expanded Operations Alternative	5-142
TABLE 5.4.3.1-1	NPDES Discharges by Watershed Under the Reduced Operations Alternative	5-144

TABLE 5.4.3.4–1	Maximum Water Level Changes at the Top of the Main Aquifer Under the Reduced Operations Alternative (1997 Through 2006)	5–145
TABLE 5.4.4.2–1	Facility-Specific Information Reduced Operations Alternative	5–146
TABLE 5.4.6.1–1	Estimated Public Health Consequences for LANL MEI and the Population Within a 50-Mile (80-Kilometer) Radius of LANL for the Reduced Operations Alternative	5–147
TABLE 5.4.6.1–2	Radiation Doses and Excess LCF Risks Estimated to the Public at Stops During Transportation of Materials and Wastes from LANL	5–151
TABLE 5.4.6.2–1	Annual Worker Doses and Associated Lifetime Excess LCF Risks Under the Reduced Operations Alternative	5–152
TABLE 5.4.6.2–2	Projected Annual Reportable Accidents and Injuries for the Reduced Operations Alternative Compared with the Index Period	5–153
TABLE 5.4.9.1–1	Summary of Primary LANL Employment, Salaries, and Procurement Under the Reduced Operations Alternative	5–156
TABLE 5.4.9.1–2	Summary of Total Tri-County Employment, Salaries, Business Activity, and Population Changes Under the Reduced Operations Alternative	5–156
TABLE 5.4.9.1–3	Construction Spending, Labor Salaries, and Labor Employment Numbers Under the Reduced Operations Alternative (Fiscal Year 1997 Through 2006)	5–157
TABLE 5.4.9.3–1	Projected Annual and 10-Year Total Waste Generation Under the Reduced Operations Alternative	5–159
TABLE 5.4.10.1–1	Truck Accident Injuries and Fatalities Projected for LANL Shipments Under the Reduced Operations Alternative	5–162
TABLE 5.4.10.2–1	Incident-Free Population Dose and Lifetime Excess LCFs for Off-Site Shipments per Year of Operation Under the Reduced Operations Alternative	5–162
TABLE 5.4.10.2–2	Bounding Radioactive Materials Off-Site Accident Population Risk for the Reduced Operations Alternative	5–163
TABLE 5.4.10.2–3	MEI Doses and Frequencies for Bounding On-Site Radioactive Materials Accidents Under the Reduced Operations Alternative	5–163
TABLE 5.4.10.2–4	Frequencies, Consequences, and Risk for a Major Chlorine Accident Under the Reduced Operations Alternative	5–165

TABLE 5.4.10.2–5	Frequencies, Consequences, and Risk for a Major Propane Accident Under the Reduced Operations Alternative	5–165
TABLE 5.4.11.5–1	Summary of Chlorine Exposure Scenarios at LANL—Reduced Operations Alternative	5–167
TABLE 5.4.11.5–2	Summary of Chemical Exposure Scenarios—Reduced Operations Alternative	5–168
TABLE 5.5.3.1–1	NPDES Discharges by Watershed Under the Greener Alternative	5–170
TABLE 5.5.3.4–1	Maximum Water Level Changes at the Top of the Main Aquifer Under the Greener Alternative (1997 Through 2006)	5–171
TABLE 5.5.4.2–1	Facility-Specific Information—Greener Alternative	5–172
TABLE 5.5.6.1–1	Estimated Public Health Consequences for LANL MEI and the Population Within 50-Mile (80-Kilometer) Radius of LANL for the Greener Alternative	5–176
TABLE 5.5.6.1–2	Radiation Doses and Excess LCF Risks Estimated to the Public at Stops During Transportation of Materials and Wastes from LANL	5–177
TABLE 5.5.6.2–1	Annual Worker Doses and Associated Lifetime Excess LCF Risks Under the Greener Alternative	5–177
TABLE 5.5.6.2–2	Projected Reportable Annual Accidents and Injuries for the Greener Alternative Compared with the Index Period	5–179
TABLE 5.5.9.1–1	Summary of Primary LANL Employment, Salaries, and Procurement Under the Greener Alternative	5–182
TABLE 5.5.9.1–2	Summary of Total Tri-County Employment, Salaries, Business Activity, and Population Changes Under the Greener Alternative	5–182
TABLE 5.5.9.1–3	Construction Spending, Labor Salaries, and Labor Employment Numbers Under the Greener Alternative (Fiscal Year 1997 Through 2006)	5–183
TABLE 5.5.9.3–1	Projected Annual and 10-Year Total Waste Generation Under the Greener Alternative	5–185
TABLE 5.5.10.1–1	Truck Accident Injuries and Fatalities Projected for LANL Shipments Under the Greener Alternative	5–188

TABLE 5.5.10.2-1	Incident-Free Population Dose and Lifetime Excess LCFs for Off-Site Shipments per Year of Operation Under the Greener Alternative	5-188
TABLE 5.5.10.2-2	Bounding Radioactive Materials Off-Site Accident Population Risk for the Greener Alternative	5-189
TABLE 5.5.10.2-3	MEI Doses and Frequencies for Bounding On-Site Radioactive Materials Accidents Under the Greener Alternative	5-189
TABLE 5.5.10.2-4	Frequencies, Consequences, and Risk for a Major Chlorine Accident Under the Greener Alternative	5-191
TABLE 5.5.10.2-5	Frequencies, Consequences, and Risk for a Major Propane Accident Under the Greener Alternative	5-191

VOLUME I

ABBREVIATIONS AND ACRONYMS

ACGIH	American Conference of Governmental Industrial Hygienists
ACIS	Automated Chemical Inventory System
ACL	administrative control level
ACM	asbestos-containing material
ADTT	accelerator-driven transmutation technology
AEA	<i>Atomic Energy Act</i>
AEC	U.S. Atomic Energy Commission
AIP	Agreement in Principle
AIRNET	ambient air monitoring program
ALARA	as low as reasonably achievable
ALOHA™	Areal Locations of Hazardous Atmospheres (computer model)
ANSI	American National Standards Institute
AO	Administrative Order
APT	accelerator production of tritium
BAT	best available technology
BIA	Bureau of Indian Affairs
BIO	Basis for Interim Operation
BLM	Bureau of Land Management
BMP	best management practice
BNM	Bandelier National Monument
BOD	biochemical/biological oxygen demand
BTC	Beryllium Technology Center
°C	degrees Celsius

CA	composite analysis
CAA	<i>Clean Air Act</i>
CAD	computer-aided design
CAM	continuous air monitor
CAMP	Capital Assets Management Process
CAP-88	Clean Air Act Assessment Package for 1988
CBD	chronic beryllium disease
CCNS	Concerned Citizens for Nuclear Safety
CDE	committed dose equivalent
CDP	Census Designated Place
CDR	Conceptual Design Report
CEDE	committed effective dose equivalent
CEQ	Council on Environmental Quality
CERCLA	<i>Comprehensive Environmental Response, Compensation, and Liability Act</i>
CFR	Code of Federal Regulations
CH	contact-handled (waste)
CH TRU	contact-handled transuranic (waste)
Ci	curie
cm	centimeter
CMIP	Capability Maintenance and Improvement Project
CMR	Chemistry and Metallurgy Research
COD	chemical oxygen demand
CRMT	Cultural Resources Management Team
CT	Conveyance and Transfer (EIS)
CTBT	Comprehensive Test Ban Treaty

CVD	chemical vapor deposition
CVI	chemical vapor infiltration
CY	calendar year
D&D	decontamination and decommissioning
DARHT	Dual Axis Radiographic Hydrodynamic Test (Facility)
dB	decibel
dBA	decibels A-weighted frequency scale
DCG	derived concentration guide
DEGADIS	dense gas dispersion (computer model)
DNFSB	Defense Nuclear Facilities Safety Board
DEL	Dynamic Experiment Laboratory
DNA	deoxyribonucleic acid
DoD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOI	U.S. Department of the Interior
DOP	detailed operating procedure
DOT	U.S. Department of Transportation
DU	depleted uranium
EA	environmental assessment
EDE	effective dose equivalent
EIS	environmental impact statement
EM	DOE Office of Environmental Management
EM&R	emergency management and response
EPA	U.S. Environmental Protection Agency
EPCRA	<i>Emergency Planning and Community-Right-to-Know Act</i>

ER	environmental restoration
ERPG	Emergency Response Planning Guideline
ES&H	Environmental, Safety and Health (division of LANL)
°F	degrees Fahrenheit
FAA	Federal Aviation Administration
FIFRA	<i>Federal Insecticide, Fungicide, and Rodenticide Act</i>
FONSI	Finding of No Significant Impact
FR	<i>Federal Register</i>
FS MEI	facility-specific maximally exposed individual
ft	feet
FTE	full-time equivalent (employees)
FU	field unit
FWS	U.S. Fish and Wildlife Service
FY	fiscal year
g	gram
GV	guideline value
GWPMPP	Groundwater Protection Management Program Plan
ha	hectares
HA	hazard analysis
HAP	hazardous air pollutant
HE	high explosives
HEFS	High Explosives Firing Site
HELWTF	High Explosives Liquid Wastewater Treatment Facility
HEPA	high-efficiency particulate air (filter)
HEPP	High Explosives Pulsed Power

HEU	highly enriched uranium
HEWTF	High Explosives Wastewater Treatment Facility
HI	hazard index
HLW	high-level waste
HRL	Health Research Laboratory
HSWA	<i>Hazardous and Solid Waste Amendments of 1984</i>
HT	tritium gas
HTO	tritiated water
HVAC	heating, ventilation, and air conditioning
HW	hazardous waste
IATA	International Air Traffic Association
ICF	inertial confinement fusion
ICRP	International Commission on Radiological Protection
IH	industrial hygiene
in.	inch
IPF	Isotope Production Facility
IR	infrared
IRIS	Integrated Risk Information System
ISC-3	Industrial Source Complex (Model) Version 3
ISCST3	Industrial Source Complex Short Term (Model)
JCI	Johnson Controls, Inc.
km	kilometer
LAC	Los Alamos County
LACEF	Los Alamos Critical Experiments Facility
LADF	Los Alamos Detonator Facility

LAMPF	Los Alamos Meson Physics Facility (former name for LANSCE)
LAMPRE	Los Alamos Molten Plutonium Reactor Experiment
LANL	Los Alamos National Laboratory
LANSCE	Los Alamos Neutron Science Center
lb	pound
LCF	latent cancer fatality
L/CHEM	low chemical hazard
LCO	limiting condition for operation
LDR	land disposal restrictions
LEDA	low-energy demonstration accelerator
L/ENS	low energetic source hazard
LIDAR	light detection and ranging
LIFT	Los Alamos International Facility for Transmutation
linac	linear accelerator
LLMW	low-level radioactive mixed waste
LLNL	Lawrence Livermore National Laboratory
LLW	low-level radioactive waste
LPSS	Long-Pulse Spallation Source
L/RAD	low radioactive hazard
LSA	low specific activity
m	meter
MAA	Material Access Area
MACCS	MELCOR Accident Consequences Code System
MAR	material-at-risk
M/CHEM	moderate chemical hazard

MCL	maximum contaminant level
MDA	Material Disposal Area
MEI	maximally exposed individual
MeV	million electron volts
MGD	million gallons per day
MGY	million gallons per year
mi	mile
MLY	million liters per year
MOU	memorandum of understanding
MOX	mixed oxide (fuel)
M/RAD	moderate radioactive hazard
MSL	Materials Science Laboratory
MW	megawatt
NA	not applicable (or not available)
NAAQS	National Ambient Air Quality Standards
NAGPRA	<i>Native American Graves Protection and Repatriation Act</i>
NCRP	National Council on Radiation Protection
NEPA	<i>National Environmental Policy Act of 1969</i> , as amended
NERP	National Environmental Research Park
NESHAP	National Emission Standards for Hazardous Air Pollutants
NFPA	National Fire Protection Association
NIOSH	U.S. National Institute for Occupational Safety and Health
NM	New Mexico (State Road)
NMAC	New Mexico Administrative Code
NMDGF	New Mexico Department of Game and Fish

NMDL	New Mexico Department of Labor
NMED	New Mexico Environment Department
NMEIB	New Mexico Environmental Improvement Board
NMSWA	<i>New Mexico Solid Waste Act</i>
NMSF	Nuclear Materials Storage Facility
NMWQCC	New Mexico Water Quality Control Commission
NOA	Notice of Availability
NOI	Notice of Intent
NO _x	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRC	U.S. Nuclear Regulatory Commission
NRHP	National Register of Historic Places
NTS	Nevada Test Site
NTTL	neutron tube target loading
OEL	occupational exposure limit
OLM	Ozone Limiting Method
ORNL	Oak Ridge National Laboratory
ORPS	Occurrence Reporting and Processing System
OSHA	Occupational Safety and Health Administration
OU	operable unit
OWR	Omega West Reactor
PA	performance assessment
PAL	plant-wide applicability limit
PCB	polychlorinated biphenyl

PDD	Presidential Decision Directive
PEIS	programmatic environmental impact statement
PF	Plutonium Facility
pH	a measure of acidity and alkalinity
PHERMEX	Pulsed High-Energy Radiation Machine Emitting X-Rays (facility)
PL	public law
PM	particulate matter
PM ₁₀	particulate matter equal to or less than 10 micrometers aerodynamic diameter
PNM	Public Service Company of New Mexico
PPE	personal protective equipment
ppb	parts per billion
ppm	parts per million
PRA	probabilistic risk assessment
PrHA	process hazard analysis
PRS	potential release site
PSD	prevention of significant deterioration
psi	pounds per square inch
PSR	proton storage ring
PSSC	project-specific siting and construction
PTLA	Protection Technology of Los Alamos
rad	radiation absorbed dose
RAMROD	Radioactive Materials Research, Operations, and Demonstration (facility)
RANT	Radioactive Assay and Nondestructive Test (facility)
RCRA	<i>Resource Conservation and Recovery Act</i>
rem	roentgen equivalent man

RF	radiofrequency (also, respirable fraction)
RfC	inhalation reference concentrations
RFETS	Rocky Flats Environmental Technology Site
RFI	RCRA Facility Investigation
RH	remote-handled (waste)
RH TRU	remote-handled transuranic (waste)
RLW	radioactive liquid waste
RLWTF	Radioactive Liquid Waste Treatment Facility
ROD	Record of Decision
ROI	region of influence
RSRL	regional statistical reference level
RTG	radioisotopic thermoelectric generator
SA	safety assessment
SAL	screening action level
SAR	safety analysis report
SARA	<i>Superfund Amendment and Reauthorization Act</i>
SCC	Strategic Computing Complex
SDWA	<i>Safe Drinking Water Act</i>
SEER	Surveillance, Epidemiology, and End Results
SEIS-II	second supplemental environmental impact statement
SFNF	Santa Fe National Forest
SHEBA	Solution High-Energy Burst Assembly
SHPO	State Historic Preservation Office(r)
SIP	State Implementation Plan
SLEV	screening level emission value

SMAC	shipment mobility/accountability collection
SNM	special nuclear material
SNS	spallation neutron source
SPD	surplus plutonium disposition
SPSS	short-pulse spallation source
SSM	Stockpile Stewardship and Management
SST	safe secure transport
START	Strategic Arms Reduction Talks (or Treaty)
STP	Sewage Treatment Plant
SVOC	semivolatile organic compound
SWDA	<i>Solid Waste Disposal Act</i>
SWEIS	site-wide environmental impact statement
SWMU	solid waste management unit
SWPP	Stormwater Pollution Prevention Plan
SWSC	sanitary wastewater systems consolidation
T&E	threatened and endangered (species)
TA	Technical Area
TCP	traditional cultural property
TEDE	total effective dose equivalent
TFF	Target Fabrication Facility
TI	transport index
TLD	thermoluminescent dosimeter
TLV	threshold limit value
TRU	transuranic (waste)
TSCA	<i>Toxic Substances Control Act</i>

TSD	treatment, storage, and disposal
TSFF	Tritium Science and Fabrication Facility
TSR	technical safety requirement
TSTA	Tritium System Test Assembly
TW	test well
TWA	time-weighted average
TWISP	Transuranic Waste Inspectable Storage Project
UC	University of California
UCL	upper confidence limit
UNM	University of New Mexico
U.S.	United States
U.S.C.	United States Code
USFS	U.S. Forest Service
USGS	U.S. Geological Survey
UST	underground storage tank
UV	ultraviolet
VOC	volatile organic compound
WAC	waste acceptance criteria
WCRR	Waste Characterization, Reduction, and Repackaging (facility)
WCTF	Weapon Component Testing Facility
WETF	Weapons Engineering Tritium Facility
WIPP	Waste Isolation Pilot Plant
WM	waste management
WNR	Weapons Neutron Research
WR	war reserve
WWTF	Waste Water Treatment Facility

VOLUME I

MEASUREMENTS AND CONVERSIONS

The following information is provided to assist the reader in understanding certain concepts in this SWEIS. Definitions of technical terms can be found in volume I, chapter 10, Glossary.

SCIENTIFIC NOTATION

Scientific notation is used in this report to express very large or very small numbers. For example, the number 1 billion could be written as 1,000,000,000 or, using scientific notation, as 1×10^9 . Translating from scientific notation to a more traditional number requires moving the decimal point either right (for a positive power of 10) or left (for a negative power of 10). If the value given is 2.0×10^3 , move the decimal point three places (insert zeros if no numbers are given) to the right of its current location. The result would be 2,000. If the value given is 2.0×10^{-5} , move the decimal point five places to the left of its present location. The result would be 0.00002. An alternative way of expressing numbers, used primarily in the appendixes of this SWEIS, is exponential notation, which is very similar in use to scientific notation. For example, using the scientific notation for 1×10^9 , in exponential notation the 10^9 (10 to the power of 9) would be replaced by E+09. (For positive powers, sometimes the “+” sign is omitted, and so the example here could be expressed as E09.) If the value is given as 2.0×10^{-5} in scientific notation, then the equivalent exponential notation is 2.0E-05.

UNITS OF MEASUREMENT

The primary units of measurement used in this report are English units with metric equivalents enclosed in parentheses.

Many metric measurements presented include prefixes that denote a multiplication factor that is applied to the base standard (e.g., 1 kilometer = 1,000 meters). The following list presents these metric prefixes:

giga	1,000,000,000 (10^9 ; E+09; one billion)
mega	1,000,000 (10^6 ; E+06; one million)
kilo	1,000 (10^3 ; E+03; one thousand)
hecto	100 (10^2 ; E+02; one hundred)
deka	10 (10^1 ; E+01; ten)
unit	1 (10^0 ; E+00; one)
deci	0.1 (10^{-1} ; E-01; one tenth)
centi	0.01 (10^{-2} ; E-02; one hundredth)
milli	0.001 (10^{-3} ; E-03; one thousandth)

micro	0.000001 (10^{-6} ; E-06; one millionth)
nano	0.000000001 (10^{-9} ; E-09; one billionth)
pico	0.000000000001 (10^{-12} ; E-12; one trillionth)

DOE Order 5900.2A, *Use of the Metric System of Measurement*, prescribes the use of this system in DOE documents. Table MC–1 lists the mathematical values or formulas needed for conversion between English and metric units. Table MC–2 summarizes and defines the terms for units of measure and corresponding symbols found throughout this report.

RADIOACTIVITY UNIT

Part of this report deals with levels of radioactivity that might be found in various environmental media. Radioactivity is a property; the amount of a radioactive material is usually expressed as “activity” in curies (Ci) (Table MC–3). The curie is the basic unit used to describe the amount of substance present, and concentrations are generally expressed in terms of curies per unit of mass or volume. One curie is equivalent to 37 billion disintegrations per second or is a quantity of any radionuclide that decays at the rate of 37 billion disintegrations per second. Disintegrations generally include emissions of alpha or beta particles, gamma radiation, or combinations of these.

RADIATION DOSE UNITS

The amount of ionizing radiation energy received by a living organism is expressed in terms of radiation dose. Radiation dose in this report is usually expressed in terms of effective dose equivalent and reported numerically in units of rem (Table MC–4). Rem is a term that relates ionizing radiation and biological effect or risk. A dose of 1 millirem (0.001 rem) has a biological effect similar to the dose received from about a 1-day exposure to natural background radiation. A list of the radionuclides discussed in this document and their half-lives is included in Table MC–5.

CHEMICAL ELEMENTS

A list of selected chemical elements, chemical constituents, and their nomenclature is presented in Table MC–6.

TABLE MC-1.—Conversion Table

MULTIPLY	BY	TO OBTAIN	MULTIPLY	BY	TO OBTAIN
ac	0.405	ha	ha	2.47	ac
°F	(°F -32) x 5/9	°C	°C	(°C x 9/5) + 32	°F
ft	0.305	m	m	3.28	ft
ft ²	0.0929	m ²	m ²	10.76	ft ²
ft ³	0.0283	m ³	m ³	35.3	ft ³
gal.	3.785	l	l	0.264	gal.
in.	2.54	cm	cm	0.394	in.
lb	0.454	kg	kg	2.205	lb
mCi/km ²	1.0	nCi/m ²	nCi/m ²	1.0	mCi/km ²
mi	1.61	km	km	0.621	mi
mi ²	2.59	km ²	km ²	0.386	mi ²
mi/h	0.447	m/s	m/s	2.237	mi/h
nCi	0.001	pCi	pCi	1,000	nCi
oz	28.35	g	g	0.0353	oz
pCi/l	10 ⁻⁹	μCi/ml	μCi/ml	10 ⁹	pCi/l
pCi/m ³	10 ⁻¹²	Ci/m ³	Ci/m ³	10 ¹²	pCi/m ³
pCi/m ³	10 ⁻¹⁵	mCi/cm ³	mCi/cm ³	10 ¹⁵	pCi/m ³
ppb	0.001	ppm	ppm	1,000	ppb
ton	0.907	metric ton	metric ton	1.102	ton

TABLE MC-2.—Names and Symbols for Units of Measure

LENGTH	
SYMBOL	NAME
cm	centimeter (1×10^{-2} m)
ft	foot
in.	inch
km	kilometer (1×10^3 m)
m	meter
mi	mile
mm	millimeter (1×10^{-3} m)
μ m	micrometer (1×10^{-6} m)
VOLUME	
SYMBOL	NAME
cm^3	cubic centimeter
ft^3	cubic foot
gal.	gallon
in.^3	cubic inch
l	liter
m^3	cubic meter
ml	milliliter (1×10^{-3} l)
ppb	parts per billion
ppm	parts per million
yd^3	cubic yard
RATE	
SYMBOL	NAME
Ci/yr	curies per year
cm^3/s	cubic meters per second
ft^3/s	cubic feet per second
ft^3/min	cubic feet per minute
gpm	gallons per minute
kg/yr	kilograms per year
km/h	kilometers per hour
mg/l	milligrams per liter
MGY	million gallons per year
MLY	million liters per year
m^3/yr	cubic meters per year
mi/h or mph	miles per hour
$\mu\text{Ci/l}$	microcuries per liter
pCi/l	picocuries per liter

TABLE MC-2.—Names and Symbols for Units of Measure-Continued

NUMERICAL RELATIONSHIPS	
SYMBOL	MEANING
<	less than
\leq	less than or equal to
>	greater than
\geq	greater than or equal to
2σ	two standard deviations
TIME	
SYMBOL	NAME
d	day
h	hour
min	minute
nsec	nanosecond
s	second
yr	year
AREA	
SYMBOL	NAME
ac	acre (640 per mi^2)
cm^2	square centimeter
ft^2	square foot
ha	hectare ($1 \times 10^4 \text{ m}^2$)
in.^2	square inch
km^2	square kilometer
mi^2	square mile
MASS	
SYMBOL	NAME
g	gram
kg	kilogram (1×10^3 g)
mg	milligram (1×10^{-3} g)
μg	microgram (1×10^{-6} g)
ng	nanogram (1×10^{-9} g)
lb	pound
ton	metric ton (1×10^6 g)
oz	ounce

TABLE MC-2.—Names and Symbols for Units of Measure-Continued

TEMPERATURE	
SYMBOL	NAME
°C	degrees Celsius
°F	degrees Fahrenheit
°K	degrees Kelvin
SOUND/NOISE	
SYMBOL	NAME
dB	decibel
dBA	A-weighted decibel

TABLE MC-4.—Names and Symbols for Units of Radiation Dose

RADIATION DOSE	
SYMBOL	NAME
mrad	millirad (1×10^{-3} rad)
mrem	millirem (1×10^{-3} rem)
R	roentgen
mR	milliroentgen (1×10^{-3} R)
μR	microroentgen (1×10^{-6} R)

TABLE MC-3.—Names and Symbols for Units of Radioactivity

RADIOACTIVITY	
SYMBOL	NAME
Ci	curie
cpm	counts per minute
mCi	millicurie (1×10^{-3} Ci)
μCi	microcurie (1×10^{-6} Ci)
nCi	nanocurie (1×10^{-9} Ci)
pCi	picocurie (1×10^{-12} Ci)

TABLE MC-5.—Radionuclide Nomenclature

SYMBOL	RADIONUCLIDE	HALF-LIFE	SYMBOL	RADIONUCLIDE	HALF-LIFE
Am-241	americium-241	432 yr	Pu-241	plutonium-241	14.4 yr
H-3	tritium	12.26 yr	Pu-242	plutonium-242	3.8×10^5 yr
Mo-99	molybdenum-99	66 hr	Pu-244	plutonium-244	8.2×10^7 yr
Pa-234	protactinium-234	6.7 hr	Th-231	thorium-231	25.5 hr
Pa-234m	protactinium-234m	1.17 min	Th-234	thorium-234	24.1 d
Pu-236	plutonium-236	2.9yr	U-234	uranium-234	2.4×10^5 yr
Pu-238	plutonium-238	87.7 yr	U-235	uranium-234	7×10^8 yr
Pu-239	plutonium-239	2.4×10^4 yr	U-238	uranium-238	4.5×10^9 yr
Pu-240	plutonium-240	6.5×10^3 yr			

TABLE MC-6.—Elemental and Chemical Constituent Nomenclature

SYMBOL	CONSTITUENT	SYMBOL	CONSTITUENT
Ag	silver	Pa	protactinium
Al	aluminum	Pb	lead
Ar	argon	Pu	plutonium
B	boron	SF ₆	sulfur hexafluoride
Be	beryllium	Si	silicon
CO	carbon monoxide	SO ₂	sulfur dioxide
CO ₂	carbon dioxide	Ta	tantalum
Cu	copper	Th	thorium
F	fluorine	Ti	titanium
Fe	iron	U	uranium
Kr	krypton	V	vanadium
N	nitrogen	W	tungsten
Ni	nickel	Xe	xenon
NO ₂ ⁻	nitrite ion	Zn	zinc
NO ₃ ⁻	nitrate ion		

ABOUT THE *NATIONAL ENVIRONMENTAL POLICY ACT*

The *National Environmental Policy Act* (NEPA) (42 United States Code [U.S.C.] §4321 *et seq.*) was enacted to ensure that federal decision makers consider the effects of proposed actions on the human environment and to lay their decisionmaking process open for public scrutiny. NEPA also created the President's Council on Environmental Quality (CEQ). The U.S. Department of Energy's (DOE's) NEPA regulations (10 Code of Federal Regulations [CFR] 1021) augment the CEQ regulations (40 CFR 1500 through 1508).

Under NEPA, an environmental impact statement (EIS) documents a federal agency's analysis of the environmental consequences that might be caused by major federal actions, defined as those proposed actions that may result in a significant impact to the environment. An EIS also:

- Explains the purpose and need for the agency to take action.
- Describes the proposed action and the reasonable alternative courses of action that the agency could take to meet the need.
- Describes what would happen if the proposed action were not implemented—the “No Action” (or status quo) Alternative.
- Describes what aspects of the human environment would be affected if the proposed action or any alternative were implemented.
- Analyzes the changes, or impacts, to the environment that would be expected to take place if the proposed action or an alternative were implemented, compared to the expected condition of the environment if no action were taken.

The DOE EIS process follows these steps:

- The Notice of Intent, published in the *Federal Register*, identifies potential EIS issues and alternatives and asks for public comment on the scope of the analysis.
- The public scoping period, with at least one public meeting, during which public comments on the scope of the document are collected and considered.
- The issuance of a draft EIS for public review and comment (for a minimum of 45 days), with at least one public hearing.
- The preparation and issuance of the final EIS, which incorporates the results of the public comment period on the draft EIS.
- Preparation and issuance of a Record of Decision, which states:
 - The decision.
 - The alternatives that were considered in the EIS and the environmentally preferable alternative.
 - All decision factors, such as cost and technical considerations, that were considered by the agency along with environmental consequences.
 - Mitigation measures designed to reduce adverse environmental impacts.
- Preparation of a Mitigation Action Plan, as appropriate, which explains how the mitigation measures will be implemented and monitored.